

Repair Manual

Engine **WM 80**



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Foreword

Machine documentation

- Keep a copy of the Operator's Manual with the machine at all times.
- Use the separate Parts Book supplied with the machine to order replacement parts.
- If you are missing any of these documents, please contact Wacker Neuson Corporation to order a replacement or visit www.wackerneuson.com.
- When ordering parts or requesting service information, be prepared to provide the machine model number, item number, revision number, and serial number.

Expectations for information in this manual

- This manual provides information and procedures to repair the above Wacker Neuson model(s). For your own safety and to reduce the risk of injury, carefully read, understand, and observe all instructions described in this manual.
- Wacker Neuson Corporation expressly reserves the right to make technical modifications, even without notice, which improve the performance or safety standards of its machines.
- The information contained in this manual is based on machines manufactured up until the time of publication. Wacker Neuson Corporation reserves the right to change any portion of this information without notice.

CALIFORNIA Proposition 65 Warning

Engine exhaust, some of its constituents, and certain vehicle components, contain or emit chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

Laws pertaining to spark arresters

NOTICE: State Health Safety Codes and Public Resources Codes specify that in certain locations spark arresters be used on internal combustion engines that use hydrocarbon fuels. A spark arrester is a device designed to prevent accidental discharge of sparks or flames from the engine exhaust. Spark arresters are qualified and rated by the United States Forest Service for this purpose. In order to comply with local laws regarding spark arresters, consult the engine distributor or the local Health and Safety Administrator.

Manufacturer's approval

This manual contains references to *approved* parts, attachments, and modifications. The following definitions apply:

- **Approved parts or attachments** are those either manufactured or provided by Wacker Neuson.
- **Approved modifications** are those performed by an authorized Wacker Neuson service center according to written instructions published by Wacker Neuson.
- **Unapproved parts, attachments, and modifications** are those that do not meet the approved criteria.

Unapproved parts, attachments, or modifications may have the following consequences:

- Serious injury hazards to the operator and persons in the work area
- Permanent damage to the machine which will not be covered under warranty

Contact your Wacker Neuson dealer immediately if you have questions about approved or unapproved parts, attachments, or modifications.

Foreword



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1 Safety Information

1.1 Signal Words Used in this Manual

This manual contains DANGER, WARNING, CAUTION, NOTICE, and NOTE signal words which must be followed to reduce the possibility of personal injury, damage to the equipment, or improper service.



This is the safety alert symbol. It is used to alert you to potential personal hazards.

- Obey all safety messages that follow this symbol.

DANGER

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

- To avoid death or serious injury from this type of hazard, obey all safety messages that follow this signal word.



WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

- To avoid possible death or serious injury from this type of hazard, obey all safety messages that follow this signal word.



CAUTION!

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

- To avoid possible minor or moderate injury from this type of hazard, obey all safety messages that follow this signal word.



NOTICE: Used without the safety alert symbol, NOTICE indicates a situation which, if not avoided, could result in property damage.

Note: A Note contains additional information important to a procedure.

1.2 Safety Guidelines for Operating the Machine

Operator qualifications

Only trained personnel are permitted to start, operate, and shut down the machine. They also must meet the following qualifications:

- have received instruction on how to properly use the machine
- are familiar with required safety devices

The machine must not be accessed or operated by:

- children
- people impaired by alcohol or drugs

Operator training

Before operating the machine:

- Read and understand the operating instructions contained in all manuals delivered with the machine.
- Familiarize yourself with the location and proper use of all controls and safety devices.
- Contact Wacker Neuson Corporation for additional training if necessary.

When operating this machine:

- Do not allow improperly trained people to operate the machine. People operating the machine must be familiar with the potential risks and hazards associated with it.

Personal Protective Equipment (PPE)

Wear the following Personal Protective Equipment (PPE) while operating this machine:

- Close-fitting work clothes that do not hinder movement
- Safety glasses with side shields
- Hearing protection
- Safety-toed footwear

- 1.2.1 Never operate this machine in applications for which it is not intended.
- 1.2.2 Do not allow anyone to operate this equipment without proper training. People operating this equipment must be familiar with the risks and hazards associated with it.
- 1.2.3 Do not touch the engine or muffler while the engine is on or immediately after it has been turned off. These areas get hot and may cause burns.
- 1.2.4 Do not operate the machine with unapproved accessories or attachments.
- 1.2.5 Never leave the machine running unattended.

- 1.2.6 Never tamper with or disable the function of operating controls.
- 1.2.7 Never use the choke to stop the engine.
- 1.2.8 Never operate the machine in areas where explosions may occur.
- 1.2.9 Read, understand, and follow procedures in the Operator's Manual before attempting to operate the machine.
- 1.2.10 Make sure that all other persons are at a safe distance from the machine. Stop the machine if people step into the working area of the machine.
- 1.2.11 Be sure operator is familiar with proper safety precautions and operation techniques before using machine.
- 1.2.12 Always keep hands, feet, and loose clothing away from moving parts of the machine.
- 1.2.13 Always use common sense and caution when operating the machine.
- 1.2.14 Always be sure the rammer will not tip over, roll, slide, or fall when not being operated.
- 1.2.15 Always turn the engine OFF when the rammer is not being operated.
- 1.2.16 Always guide the rammer in such a way that the operator is not squeezed between the rammer and solid objects. Special care is required when working on uneven ground or when compacting coarse material. Make sure to stand firmly when operating the machine under such conditions.
- 1.2.17 When working near the edges of breaks, pits, slopes, trenches and platforms, always operate the rammer in such a way that there is no danger of it tipping over or falling in.
- 1.2.18 Store the machine properly when it is not being used. The machine should be stored in a clean, dry location out of the reach of children.
- 1.2.19 Close fuel valve on engines equipped with one when machine is not being operated.
- 1.2.20 Always operate machine with all safety devices and guards in place and in working order. Do not modify or defeat safety devices. Do not operate machine if any safety devices or guards are missing or inoperative.
- 1.2.21 Do not transport the machine while it is running.
- 1.2.22 Do not tip the machine for cleaning or for any other reason.

1.3 Operator Safety while Using Internal Combustion Engines



WARNING

Internal combustion engines present special hazards during operation and fueling. Failure to follow the warnings and safety standards could result in severe injury or death.

- ▶ Read and follow the warning instructions in the engine owner's manual and the safety guidelines below.



DANGER

Exhaust gas from the engine contains carbon monoxide, a deadly poison. Exposure to carbon monoxide can kill you in minutes.

- ▶ NEVER operate the machine inside an enclosed area, such as a tunnel, unless adequate ventilation is provided through such items as exhaust fans or hoses.

Operating safety

When running the engine:

- Keep the area around exhaust pipe free of flammable materials.
- Check the fuel lines and the fuel tank for leaks and cracks before starting the engine. Do not run the machine if fuel leaks are present or the fuel lines are loose.

When running the engine:

- Do not smoke while operating the machine.
- Do not run the engine near sparks or open flames.
- Do not touch the engine or muffler while the engine is running or immediately after it has been turned off.
- Do not operate a machine when its fuel cap is loose or missing.
- Do not start the engine if fuel has spilled or a fuel odor is present. Move the machine away from the spill and wipe the machine dry before starting.

Refueling safety

When refueling the engine:

- Clean up any spilled fuel immediately.
- Refill the fuel tank in a well-ventilated area.
- Replace the fuel tank cap after refueling.
- Do not smoke.
- Do not refuel a hot or running engine.
- Do not refuel the engine near sparks or open flames.

- Do not refuel if the machine is positioned in a truck fitted with a plastic bed liner. Static electricity can ignite the fuel or fuel vapors.

1.4 Service Safety



WARNING

A poorly maintained machine can become a safety hazard! In order for the machine to operate safely and properly over a long period of time, periodic maintenance and occasional repairs are necessary.

- 1.4.1 Do not attempt to clean or service the machine while it is running. Rotating parts can cause severe injury.
- 1.4.2 DO NOT operate the machine without an air cleaner.
- 1.4.3 DO NOT remove air cleaner cover, paper element, or precleaner while engine is running.
- 1.4.4 DO NOT alter engine speeds. Run the engine only at speeds specified in the Technical Data Section.
- 1.4.5 Do not crank a flooded engine with the spark plug removed on gasoline-powered engines. Fuel trapped in the cylinder will squirt out the spark plug opening.
- 1.4.6 Do not test for spark on gasoline-powered engines if the engine is flooded or the smell of gasoline is present. A stray spark could ignite the fumes.
- 1.4.7 Do not use gasoline or other types of fuels or flammable solvents to clean parts, especially in enclosed areas. Fumes from fuels and solvents can become explosive.
- 1.4.8 ALWAYS replace the safety devices and guards after repairs and maintenance.
- 1.4.9 Keep the area around the muffler free of debris such as leaves, paper, cartons, etc. A hot muffler could ignite the debris and start a fire.
- 1.4.10 ALWAYS do periodic maintenance as recommended in the Operator's Manual.
- 1.4.11 ALWAYS clean debris from engine cooling fins.
- 1.4.12 Replace worn or damaged components with spare parts designed and recommended by Wacker Neuson Corporation.
- 1.4.13 Disconnect the spark plug on machines equipped with gasoline engines, before servicing, to avoid accidental start-up.
- 1.4.14 Keep the machine clean and labels legible. Replace all missing and hard-to-read labels. Labels provide important operating instructions and warn of dangers and hazards.

2 Technical Data

2.1 Engine Specifications

Engine Model	WM 80
Type	2-cycle
Maximum rated power (kW) hp	3.0 (4.0)
Number of cylinders	1
Piston displacement cc (cu.in.)	80 (4.9)
Cylinder bore mm (in.)	(45) 1.77
Stroke mm (in.)	50 (1.96)
Compression ratio	9:1
Operating speed range rpm	3,000–5,000
Starter	Pull-type, recoil starter
Ignition	Transistor-controlled electronic (TCI)
Carburetor	Diaphragm
Fuel	Gas/oil mixture
Fuel:oil ratio	between 120–50:1 (first tank 25:1)
Cooling	Forced air
Weight kg (lbs.)	7.8 (17)
Direction of rotation	Counterclockwise when viewed from drive end

2.2 Tune-up Specifications

Engine Model	WM 80	
Ring gap: New mm (in.) Maximum mm (in.)		0.2–0.4 (0.008–0.016) 1.0–1.2 (0.039–0.047)
Cylinder wear: Maximum bore taper mm (in.)		0.2 (0.008)
Cylinder head compression kg/cc (psi)		8.0–9.7 (120–140)
Ignition module air gap* mm (in.)		0.4 (0.016)
Spark plug gap: Champion RL86C mm (in.) Champion UJ11G mm (in.) Champion RL95YC** mm (in.)		0.5 (0.020) 1.0–1.1 (0.040–0.045) 0.5 (0.020)

* On models with adjustable air gap

** Must be used on models with oil injection

2.3 Carburetor Specifications for Bing, and Tillotson (Standard**)

Machine	Carburetor Make	Low-speed jet size (x 0.01)	High-speed jet size (x 0.01)	Carburetor adapter bore diameter mm (in.)
BS 45Y	•Bing •Tillotson •Tillotson w/ idle bypass	#35 Adjustable #36	#62 #71* #70	8 (0.315) 8 (0.315) 8 (0.315)
BS 50	Bing	#40	#64	12 (0.472)
BS 52Y	•Bing •Tillotson •Tillotson w/ idle bypass	#35 Adjustable #36	#62 #71* #70	9 (0.354) 9 (0.354) 9 (0.354)
BS 60Y	•Bing •Tillotson •Tillotson w/ idle bypass	#35 Adjustable #36	#62 #71* #70	12 (0.472) 11 (0.433) 11 (0.433)
BS 62Y	•Bing •Tillotson •Tillotson w/ idle bypass	#35 Adjustable #36	#62 #71* #70	12 (0.472) 14 (0.551) 14 (0.551)
BS 65Y	Bing	#35	#62	16 (0.630)
BS 100Y		#40	#64	16 (0.630)
BPS 1330		#40	#58	10 (0.394)
BPS 1350		#40	#58	10 (0.394)
BVNPN		#40	#64	12 (0.472)
BHF 30S		#40	#58	16 (0.630)
BH 23	Tillotson w/ idle bypass	#42	#74	10 (0.394)
BS 500 7550 Rev. 100–102	Tillotson w/ idle bypass	#36	#78	13 (0.512)
BS 500 7550 Rev. 103–110		#36	#66	13 (0.512)

BS 500 7550 Rev. 111–121	Tillotson w/ idle bypass	#36	#70	13 (0.512)
BS 500 7550 Rev. >121		#36	#70	11 (0.433)
BS 500 8048 Rev. 100–102		#36	#78	13 (0.512)
BS 500 8048 Rev. 103–110		#36	#66	13 (0.512)
BS 500 8048 Rev. 111–118		#36	#70	13 (0.512)
BS 500 8048 Rev. >118		#36	#70	11 (0.433)
BS 500 8049 Rev. 100–102		#36	#78	13 (0.512)
BS 500 8049 Rev. 103–110		#36	#66	13 (0.512)
BS 500 8049 Rev. 111–119		#36	#70	13 (0.512)
BS 500 8049 Rev. >120		#36	#70	11 (0.433)
BS 500 9074 High Altitude Rev. 116		#36	#70	16 (0.630)
BS 500oi 9166		#36	#72	11 (0.433)
BS 600 7551 Rev. 100–103		#36	#78	14 (0.551)
BS 600 7551 Rev. 105–120		#36	#66	13 (0.512)
BS 600 7551 Rev. >121		#36	#72	13 (0.512)
BS 600 8207 High Altitude Rev. <104		#36	#78	16 (0.630)

BS 600 8207 High Altitude Rev. > 104	Tillotson w/ idle bypass	#36	#74	18 (0.709)
BS 600oi 9166		#36	#72	18 (0.709)
BS 600oi 9262 High Altitude		#36	#74	18 (0.709)
BS 700 7552 Rev. <104		#36	#78	16 (0.630)
BS 700 7552 Rev. 104–118		#36	#74	18 (0.709)
BS 700 7552 Rev. >118		#36	#74	18 (0.709)
BS 700 8051 Rev. 100–120		#36	#78	16 (0.630)
BS 700 8051 Rev. >120		#36	#74	16 (0.630)
BS 700 8052 Rev. 100–102		#36	#78	16 (0.630)
BS 700 8052 Rev. 103–118		#36	#74	18 (0.709)
BS 700 8052 Rev. >118		#36	#74	18 (0.709)
BS 700oi 9167		#36	#74	18 (0.709)
BS 50-2 9384		#36	#72	19 (0.748)
BS 50-2i 9338		#36	#72	19 (0.748)
BS 50-2i 9383		#36	#72	19 (0.748)
BS 60-2i 9339		#36	#72	19 (0.748)
BS 60-2i 9393		#36	#72	19 (0.748)
BS 70-2i 9341		#36	#72	19 (0.748)
BS 70-2i 9401		#36	#72	19 (0.748)

* Single-needle Tillotson carburetors only. Dual-needle Tillotson carburetors use an adjustable needle for high-speed adjustment.

** Standard sizes listed. Operation at altitudes above 3000 m (5000 feet) may require different jet and carburetor adapter sizes. Contact Wacker Neuson Service for the modifications required.

2.4 Operating and Idle Speeds

Machine	Idle speed ±100 rpm	Full speed ±100 rpm
BS 45Y	1800	4300
BS 52Y	1800	4300
BS 60Y	1800	4600
BS 62Y	1800	4500
BS 65Y	1500	4400
BS 100Y	1500	4300
BS 105Y/92Y	1500	4400
BPS 1330	1500	4800
BPS 1350	1500	4800
BVNPN	1700	4500
BHF 30S	1500	4300
BH 23	1500	4250
BS 500	1800	4400
BS 500-oi	1800	4400
BS 50-2	1800	4400
BS 50-2i	1800	4400
BS 600	1800	4350
BS 600-oi	1800	4350
BS 60-2	1800	4350
BS 60-2i	1800	4350
BS 650	1800	4350
BS 65V	1800	4350
BS 700	1800	4350
BS 700-oi	1800	4350
BS 70-2	1800	4350
BS 70-2i	1800	4350

3 Maintenance**3.1 Periodic Maintenance Schedule**

	Daily	After first 5 hours	Every week or 25 Hours	Every month or 100 Hours	Every 3 months or 300 hours
Check fuel level.	•				
Clean and/or inspect air filter (cartridge type).	•				
Clean and oil foam precleaner where equipped.	•				
Check condition of fuel lines.	•				
Check & tighten engine cylinder screws.		•	•		
Check & tighten external fasteners.		•	•		
Clean and check spark plug gap.		•	•		
Clean engine cooling fins.			•		
Replace cartridge style air filter element.				•	
Replace spark plug.				•	
Clean recoil starter.					•
Remove carbon deposits from muffler & cylinder exhaust port.					•
Replace in-line fuel filter.					•
Inspect in-tank fuel filter.					•

3.2 Storage

If storing the unit for a long period of time (more than 30 days) carry out the following:

- 3.2.1 Drain fuel from the tank.
- 3.2.2 Start the engine and run it until all the fuel in the carburetor is used.
- 3.2.3 Remove the spark plug and pour 30 ml (1 oz.) of clean SAE 30W engine oil into the cylinder through the spark plug opening.
- 3.2.4 Pull the starter rope slowly to distribute oil in the engine.
- 3.2.5 Reinstall the spark plug.

3.3 General Air Filter Maintenance

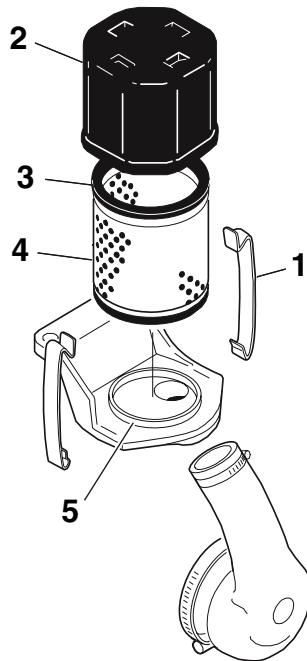
Inspect the air filter daily. Severe damage to the engine components can occur if the engine is operated with a damaged element. This is especially important when operating in extremely dusty conditions; dirt and sand, if allowed to enter the engine, can quickly destroy the cylinder wall and piston.

NOTICE: Never operate the engine without an air filter. Damage to the engine will occur.

3.4 Cartridge-Type Air Filter

See Graphic: *wc_gr002875*

- 3.4.1 This type of air filter is found on rammers with Bing carburetors and on early rammers with Tillotson carburetors. To service:
 - 3.4.2 Unsnap the spring clips (1) on the protective cover (2) and remove the filter element (3).
 - 3.4.3 Inspect the paper filter element and replace it if it appears wet, heavily soiled, or torn.
 - 3.4.4 Inspect the condition of the rubber seals (4) on each end of the element. Replace the element if the seals are damaged or deformed.
 - 3.4.5 The element can be cleaned by tapping it against a firm surface. Take care not to damage the seals or puncture the filter paper when cleaning the filter. Do not use cleaning agents or solvents to clean the filter.
 - 3.4.6 Clean and inspect the seating surfaces on the mounting base (5) and inside of the protective cover. Replace any damaged parts. Lightly oil filter the seals and install the element.



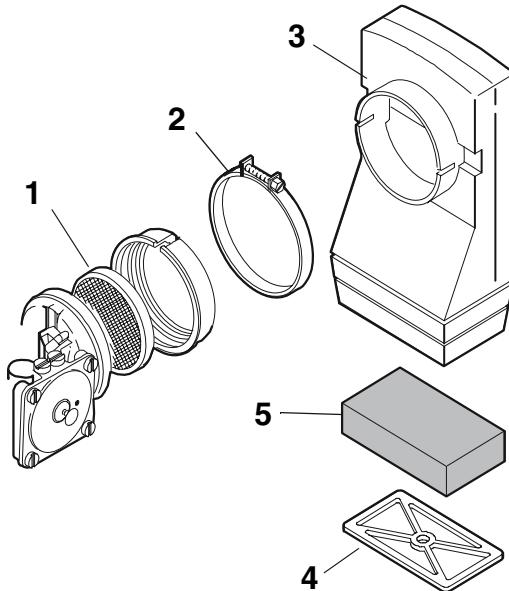
wc_gr002875

3.5 Disc-Type Air Filter

See Graphic: *wc_gr002876*

The disc-type air filter with oil-wetted foam precleaner is used on BPS 1330, BPS 1350, BVPN 50, and the BHF 30S. To service the filter:

- 3.5.1 Close the carburetor choke. Loosen the clamp (1) around the carburetor and remove the precleaner housing (2).
- 3.5.2 Remove the metal screen (3) from the carburetor and inspect it. Replace the screen if it is heavily soiled or damaged. The screen can be cleaned by tapping it against a firm surface or by using low-pressure (30 psi) compressed air.
- 3.5.3 Remove the retainer (4) and the foam precleaner (5) from the housing and inspect. Replace the precleaner if it appears heavily soiled or damaged. The precleaner can be cleaned by using a mild detergent and warm water. Rinse it thoroughly and dry it with a lint-free cloth.
- 3.5.4 After cleaning, soak the precleaner in clean engine oil (SAE 30W), squeeze out excess oil, and reinstall the filter.



wc_gr002876

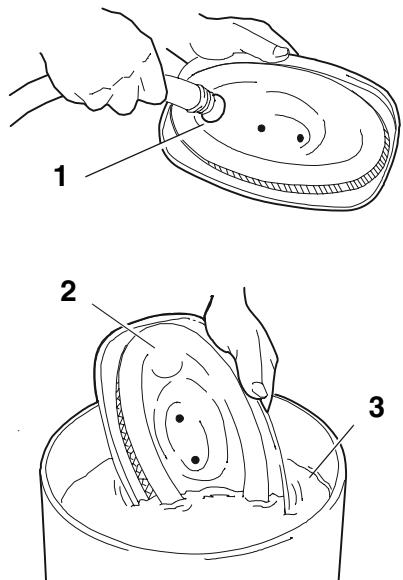
3.6 Low-Maintenance Air Filter

See Graphic: *wc_gr002877*

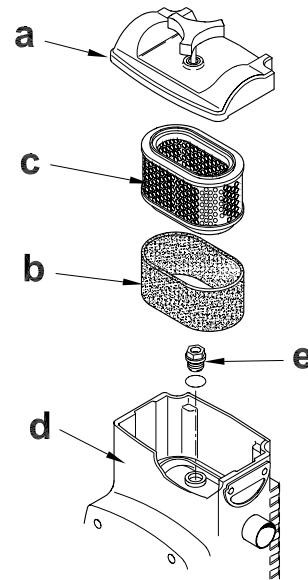
This type of air filter is found on rammers. The air filter is self-cleaning and uses the movement of the machine to shake dust and dirt loose from the air filter element while the rammer is operating. Under normal operating conditions this element will not require cleaning and should not be removed from the machine. If the element does become plugged with dirt, the engine will begin to lose power. In this case, the air filter element can be removed and cleaned as described below. Replace the element if it becomes so plugged with dirt it can no longer be cleaned.

- 3.6.1 Remove the two locknuts from the top of the air filter and lift the air filter off.
- 3.6.2 Use compressed air directed from the inside of the air filter, through the grommet hole **(1)**, to blow dirt and dust from the element.
NOTICE: Air pressure must not exceed 100 psi.
- 3.6.3 Run fresh water through the grommet hole **(1)** until water runs clear
NOTICE: **DO NOT** use solvents, fuel oil, or gasoline to wash the filter.
- 3.6.4 Plug or cover the hole in the air filter **(2)** using a cork or tape to prevent dirty water from entering inside the element. Soak the air filter in a solution **(3)** of warm water and a low-suds detergent for at least 15 minutes. Longer periods of time (up to several hours) of soaking may be required, depending on how dirty the element is.
- 3.6.5 Remove the air filter from the water and repeat rinsing the filter as described in Step 3. Allow the element to air dry in a dust-free area. **DO NOT** use heat to speed drying.
- 3.6.6 Inspect the grommet before assembly and replace it if it is worn or damaged. Install the grommet on the element carefully to avoid cutting it.
- 3.6.7 Install the air filter on the machine and secure it with washers and locknuts. **DO NOT** overtighten. Overtightening can deform washers and indent the top of the air filter.

Note: *Apply grease or liquid soap to inside of grommet so it slides easily on machine.*



wc_gr002877



wc_gr000046

3.7 Dual-Element Air Cleaner

See Graphic: *wc_gr000046*



WARNING

NEVER use gasoline or other types of low flash-point solvents for cleaning the air cleaner. A fire or explosion could result.

NOTICE: NEVER run engine without air cleaner. Severe engine damage will occur.

The rammer is equipped with a dual-element air cleaner. Under normal operating conditions, elements should be cleaned once every week. Under severe, dry and dusty conditions, the elements should be maintained daily. Replace an element when saturated with dirt that cannot be removed. Clean elements using the following procedure:

- 3.7.1 Remove air cleaner cover **(a)**. Remove precleaner and paper element and inspect them for holes or tears. Replace if damaged.
- 3.7.2 Precleaner **(b)**: Clean with low-pressure compressed air. When very soiled, wash in solution of mild detergent and warm water. Rinse thoroughly in clean water. Allow to dry thoroughly before re-installing.

Note: *Do not oil precleaner.*

- 3.7.3 Paper element **(c)**: Tap element lightly to remove excess dirt. Replace paper element if it appears heavily soiled.
- 3.7.4 Wipe out filter housing **(d)** with a clean cloth.

NOTICE: Do not allow dirt to get into the engine intake port while cleaning—damage to the engine will result.

3.8 Three-Stage Air Cleaners

See Graphic: *wc_gr001168*



NEVER use gasoline or other types of low flash point solvents for cleaning the air filter. A fire or explosion could result.

NOTICE: NEVER run engine without main paper filter element **(b)**. Severe engine damage will occur.

Filter Indicator

The air intake system is equipped with a filter indicator **(h)**, which indicates when a filter change is required. Replace the main paper filter element **(b)** when the yellow plunger of the indicator appears in or near the red line. Push and hold in the yellow plunger on top of the indicator to reset it after replacing the main paper filter element.

Clean elements using the following procedure:

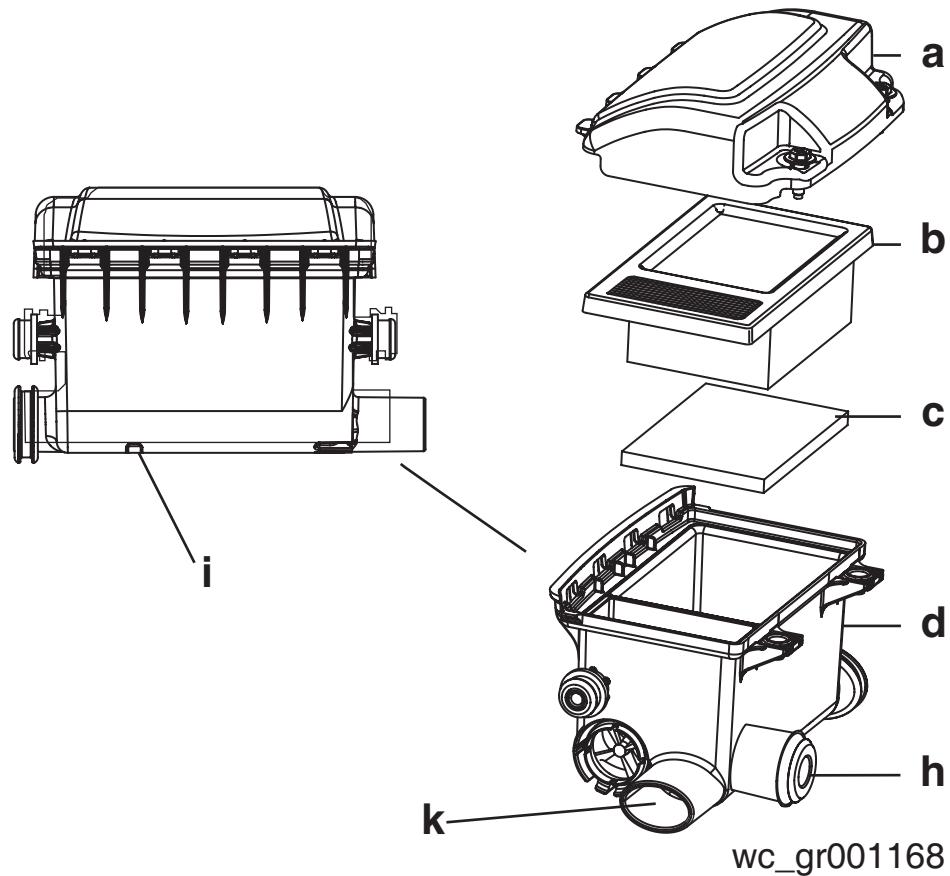
- 3.8.1 Remove the air cleaner cover **(a)**. Remove the main paper filter element **(b)** and the secondary prefilter **(c)** and inspect them for holes or tears. Replace the elements if they are damaged.
- 3.8.2 Main paper filter element **(b)**: Replace the main paper filter element if it appears heavily soiled and/or when the yellow plunger of indicator appears in or near the red line.
- 3.8.3 Prefilter **(c)**: Clean it with low-pressure compressed air. When the prefilter is very soiled, wash it in a solution of mild detergent and warm water. Rinse it thoroughly in clean water. Allow the prefilter to dry thoroughly before reinstalling it.

Note: *Do not oil the prefilter.*

- 3.8.4 Wipe out the filter housing **(d)** with a clean cloth. Do not use compressed air.

NOTICE: Do not allow dirt to get into the engine intake port **(k)** while cleaning. Damage to engine will result.

- 3.8.5 Check that the precleaner debris ejector slot **(i)** is clear.



3.9 Engine Cleaning

The WACKER WM 80 engine is air cooled and depends on the cylinder cooling fins to dissipate heat. Dirt and debris caught in the cooling fins can prevent them from dissipating heat causing the engine to overheat. For this reason, it is important to inspect and clean the fins as often as job conditions dictate. Clean debris from between the fins using a screwdriver or similar implement.

3.10 Spark Plug

A well-maintained spark plug is essential to good combustion. Keep the spark plug's electrode clean and gapped to the correct setting. See section *Tune-up Specifications*. Before removing the spark plug from the engine, clean the immediate area around the spark plug to prevent any dirt from falling into the cylinder when the spark plug is removed.

NOTICE: Do not remove the spark plug while the engine is hot. The aluminum threads of the cylinder may strip.

3.11 Muffler

See Graphic: *wc_gr005088, wc_gr007375*

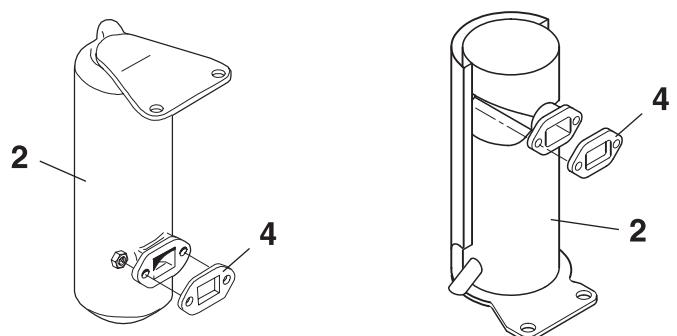
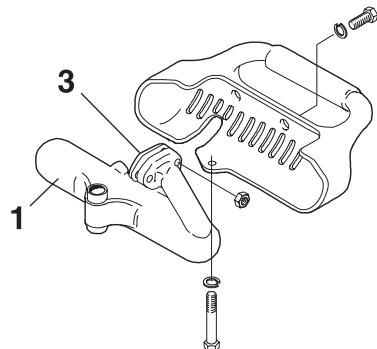
Carbon deposits normally form over a period of time at the engine exhaust and the muffler. If allowed to accumulate, these deposits may eventually restrict the exhaust passages, resulting in poor performance and hard starting. Factors contributing to excessive carbon buildup include:

- Too much oil in the fuel mixture
- Dirty air filter
- Excessive idling
- Dirty carburetor
- Too rich fuel/air mixture
- Incorrect fuel jets

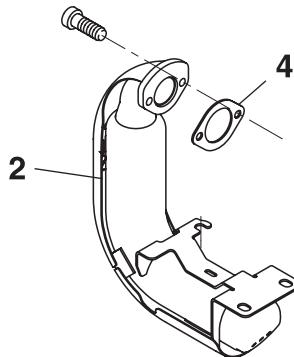
To service the muffler:

- 3.11.1 Remove the muffler (1, 2) from the engine.
- 3.11.2 Crank the engine until the piston is at the top of its stroke and covering the exhaust port.

- 3.11.3 Clean the exhaust port using a blunt scraper. Inspect the gasket (3, 4) and replace it if torn or cracked.
- 3.11.4 Soak the muffler in carburetor cleaner until the carbon deposits break up. Drain the muffler and blow dry it dry with compressed air.



wc_gr005088

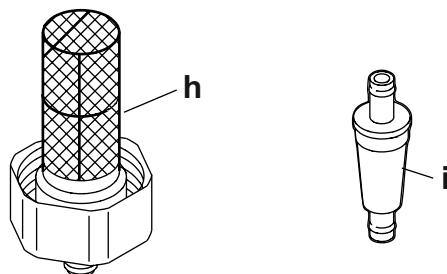


wc_gr007375

3.12 Fuel Filter

See Graphic: *wc_gr002879*

Dirt is the primary cause of carburetor problems. Unfiltered fuel can quickly plug the passages in the carburetor and cause poor performance. Two different styles of fuel filters are used with the WM 80 engine. One is an in-tank, self-cleaning style (**h**), the other is an in-line replaceable filter (**i**). No matter the style, it is imperative the fuel filter be clean. Check in-line fuel filters often and replace at regular intervals. Check in-tank fuel filters yearly. Clean the filter by back flushing with solvent. Replace the fuel filter if necessary. See section *Periodic Maintenance Schedule*.



wc_gr002879

3.13 Fuel Hoses

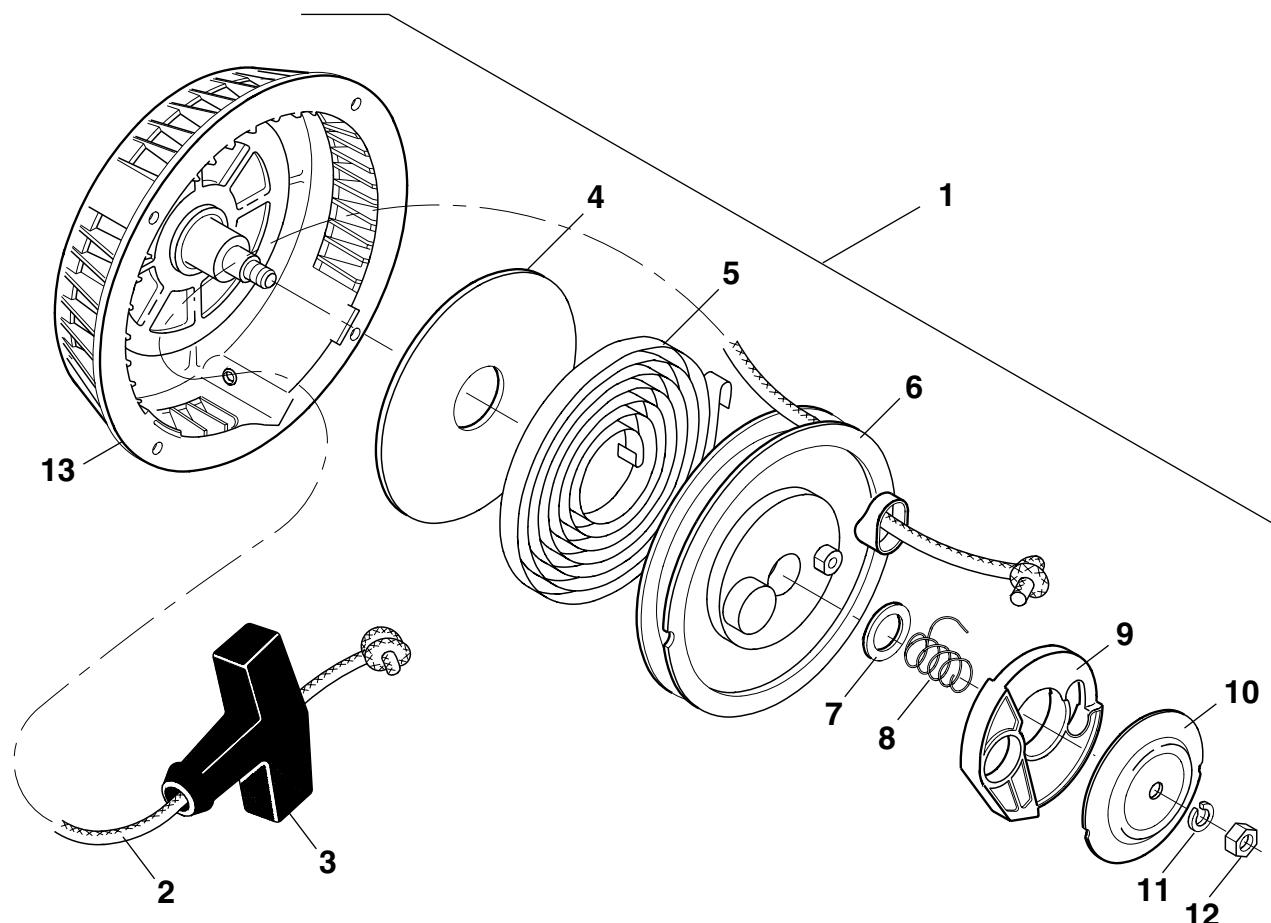
Check the condition of the fuel hoses frequently and make sure they are adequately clamped at the tanks and the filters.



Use extreme caution when working on the fuel system. Do not spill fuel on yourself or others. Clean up any spilled fuel. See section *Engine Safety*.

4 Starting and Ignition

4.1 Starter Assembly Exploded View



wc_gr002880

See Graphic: wc_gr002880

Ref	Description	Ref	Description
1	Starter assembly	8	Spring
2	Rope	9	Ratchet wheel
3	Handle	10	Cover
4	Wear plate	11	Lock washer
5	Return spring	12	Locknut
6	Starter pulley	13	Starter housing
7	Washer	-	--

4.2 Disassembling the Starter

See Graphic: *wc_gr002880*

- 4.2.1 Remove the starter assembly from the fan cover and release the spring tension as described in section *Replacing the Starter Rope*.
- 4.2.2 Untie the rope **(2)** and remove the handle **(3)**.
- 4.2.3 Remove the locknut **(12)**, lock washer **(11)**, and cover **(10)**.
- 4.2.4 Remove the ratchet **(9)**, spring **(8)**, and washer **(7)**. Note the position of the ratchet and the spring to ensure proper reassembly.
- 4.2.5 Slowly lift the rope reel pulley **(6)** from the starter housing **(13)**. Also remove the wear plate **(4)**. If necessary, carefully remove the spring **(5)** from the rope reel pulley.

4.3 Inspecting the Starter

See Graphic: *wc_gr002881*

Starter Return Spring

Replace the starter return spring if it is broken, or appears distorted or twisted. Check that the starter return spring ends are bent 180° **(a)**. The starter return spring may be difficult to seat in the slots on the starter housing and the rope reel pulley, if the return spring ends are stretched out **(b)** or damaged.

Rope Reel Pulley

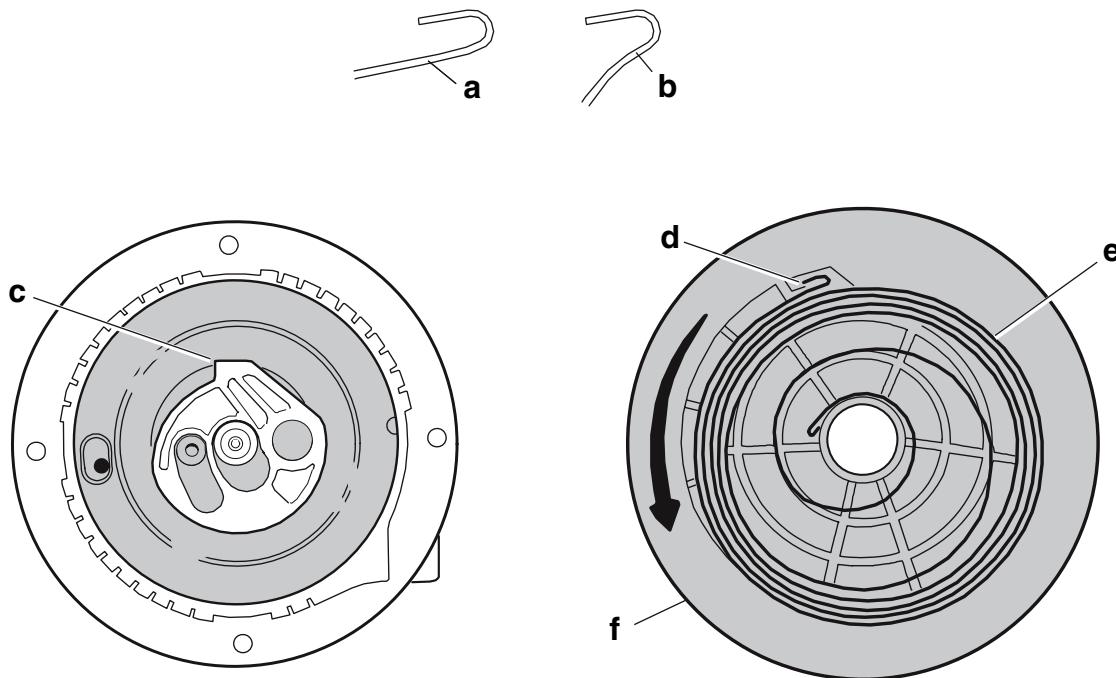
Inspect the rope reel pulley for wear in the area where the starter return spring makes contact. Remove any dirt and grease from between the spring windings. Slip the rope reel pulley over the center post in the housing and check its movement. The rope reel pulley should rotate freely on the post with a minimum amount of side play.

Ratchet

Check the ratchet tooth for wear. The tip **(c)** should be pointed, not rounded. A worn ratchet may slip when engaging the flywheel. Replace the ratchet when it is worn.

Rope

Check the rope length. It is 150 cm (60 in.) when new. If the rope is too short, it may bottom out when pulled and damage the starter.



wc_gr002881

4.4 Assembling the Starter

See Graphic: *wc_gr002880 and wc_gr002881*

- 4.4.1 Clean all the components of the starter before reassembling the starter.
- 4.4.2 **Note:** *To reduce dirt and dust from collecting between the spring windings, avoid using grease to lubricate the tarter return spring or the inside of the reel where the spring seats. Use a light lubricating oil such as WD40 instead.*
- 4.4.3 Install the spring (e)(5) by placing the outside end of the spring in the slot (d) on the rope reel pulley (f) (6). Wrap the spring in a counterclockwise direction inside the pulley until it is completely wound. Oil the spring lightly once it is wound.
- 4.4.4 Lightly grease the center post of the housing and install the wear plate (4) and the rope reel pulley. Rotate the rope reel pulley until the spring seats in the slot at the center of the housing (13). Install the washer (7) over the center post and seat it into the rope reel pulley.
NOTICE: Failure to replace the washer will cause the ratchet to bind and prevent the rope reel pulley from rotating freely.
- 4.4.5 Add the spring (8) and the ratchet (9) to the assembly. Do not grease the ratchet.
- 4.4.6 Install the cover (10) and secure it in place using the lock washer (11) and locknut (12). Torque the locknut to 8 Nm (6 ft.lbs.). Install the rope as described in section *Starter Rope Replacement*.

4.5 Replacing the Starter Rope

See Graphic: *wc_gr002882*

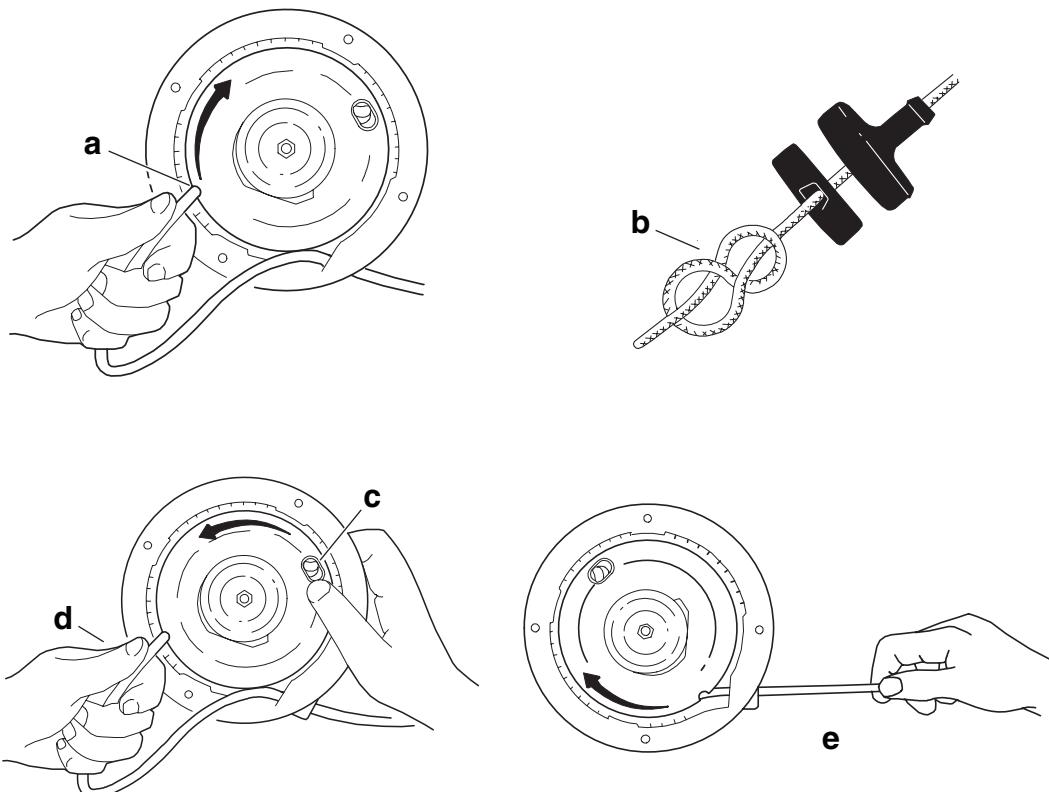
The starter rope can be replaced without removing the rope reel pulley from the starter assembly.

Removal:

- 4.5.1 Remove the starter assembly from the flywheel housing.
- 4.5.2 Lift the rope through the notch **(a)** in the drum. Pull out as much of the rope as possible. Hold the rope and let the spring pull the drum around clockwise until all spring tension is released.
- 4.5.3 Untie the knot and remove the rope.

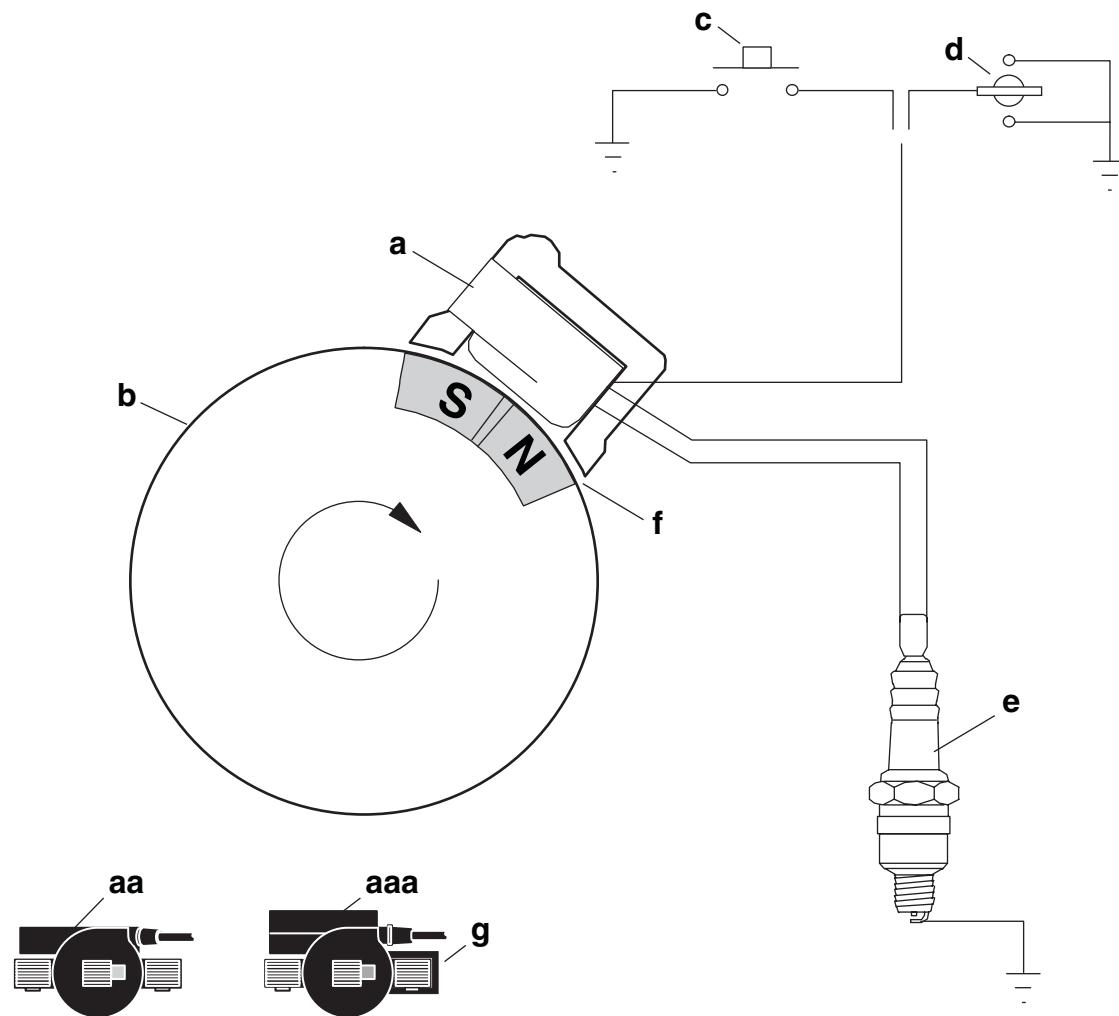
Installation:

- 4.5.4 Thread the new rope through the rope reel pulley and then through the housing. Install the handle and knot **(b)** each end of the rope as shown. Be sure the end of the rope does not protrude from the rope reel **(c)** or it may interfere with the movement of the starter.
- 4.5.5 Lift the rope up through the notch in the edge of the drum and rotate the drum counterclockwise to wind the spring. Guide **(d)** the rope around as the drum is rotated. After two complete revolutions, remove the rope from the notch and allow it to be pulled around the drum by the spring tension **(e)**. Repeat this procedure until all the rope is on the drum and the handle rests against the housing.
- 4.5.6 Reattach the starter assembly to the flywheel housing.



wc_gr002882

4.6 Ignition System Diagram



wc_gr002883

4.7 Ignition System Operation

See Graphic: *wc_gr002883*

The ignition system consists of the ignition module **(a)**, flywheel **(b)**, shutoff switch **(c)** or **(d)**, and spark plug **(e)**.

During each engine revolution, a permanent magnet **(f)** embedded in the flywheel passes under the ignition module. As the magnet passes the module, it induces a current in the primary side of the coil. After it passes, the triggering circuit is activated and the current flow to the coil is interrupted. The resulting collapse of the magnetic field around the coil secondary causes a voltage discharge to fire the spark plug.

Older Ignition Systems

Spark is provided by a breakerless electronic Transistor Controlled Ignition (TCI). There are no breaker points or capacitors. The ignition module is completely self-contained and fully enclosed. It includes the ignition coil and triggering circuit. Two different modules are used. The standard module **(aa)** is used in all applications except for rammer models BS62Y and BS65Y. On these models an ignition module **(aaa)** with speed limiter is used. This module cuts out ignition pulses at higher speeds to keep the engine from running away. The two modules are not interchangeable. Note the physical differences as shown. The speed limiting module has an extra coil **(g)** and a yellow ground wire. The standard module has no extra coil and a blue ground wire.

NOTICE: Do not use the standard module on the BS62Y or the BS65Y rammers. Engine damage will occur.

Newer Ignition Systems

Starting with Rammer Models BS 500 and BS 600 (including models with oil-injection) and carrying through to current Rammer Models BS 50-2 and BS 60-2 (also including models with oil-injection) a microprocessor-based ignition system is used. This retarding-type ignition alters the timing (advance or retard) of the spark to match the load.

Two different styles of engine shutoff switches are used. One is a stop switch **(c)** located on the engine housing (breakers, plates). The other is a fuel/shutoff switch **(d)** located under the fuel tank (rammers). This switch cuts power to the engine and closes the fuel valve. Both styles of shutoff switches are normally open and when activated create a short circuit directly to ground. The short circuit prevents the plug from firing and thus stops the engine.

4.8 Checking Spark

Remove the spark plug and inspect the electrode and insulator for damage. Also check electrode for proper gap. See section *Tune-up Specifications*. Return the spark plug to the cylinder before checking for spark.



WARNING Do not check for spark with the spark plug removed. Fuel could squirt out of the spark plug opening.



WARNING Do not touch or lean against the engine when checking for spark. Touching or leaning against engine when checking spark can result in electric shock.



WARNING Do not check for spark near flammable gases, liquids, or materials. The spark may ignite them.

- 4.8.1 To check for spark, carry out the following procedures:
- 4.8.2 Unscrew the cap from the end of the ignition cable and insert a short length of stiff, bare wire into the cable and allow it to extend slightly from the end.
- 4.8.3 Hold the ignition cable with the bare wire approximately 3 mm (1/8-inch) from the engine cylinder and pull the rope on the rewind starter.
- 4.8.4 If a strong blue spark is observed, the ignition module is satisfactory and either the spark plug or the connection in the cap is faulty.
- 4.8.5 If no spark is observed, remove the engine hood and disconnect the wire from the stop switch. Also check the air gap in module. Check for spark in same manner as before. Make sure the ground wire does not touch the engine.
- 4.8.6 If spark occurs with switch disconnected, the switch is defective. If spark is still not present, the ignition module or wires are faulty.

Note: *Checking for spark does not always provide a reliable test of the ignition system. A weak ignition module may generate sufficient voltage to fire the plug when removed from the cylinder but not enough when it is under compression in the cylinder.*

Lack of spark may not be the result of a faulty ignition module. Before replacing the ignition module, check for:

- Bad or fouled spark plug
- Metal connector in spark plug cap corroded or broken
- Broken, frayed, or shorted ignition wire or ground lead

- Poor wire connections
- Defective stop switch
- Incorrect air gap
- Weak or dead flywheel magnet
- Insufficient rpm (must have 500 min.)

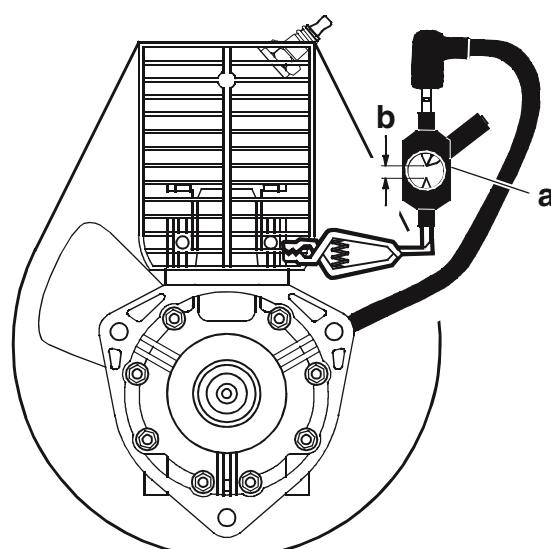
4.9 Using Ignition Tester

See Graphic: *wc_gr002884*

A more accurate test of the ignition module can be made using ignition tester P/N 78836 (a).

- 4.9.1 Preset gap to 4.2 mm (0.166 in.) (b).
- 4.9.2 Attach the end of the ignition cable to one end of the tester. Ground the other end of the tester by clipping it onto the engine cylinder. Crank the engine using the rewind starter or by spinning the flywheel. If a spark jumps the test gap, the ignition system is operating satisfactorily.

Note: A minimum of 500 rpm is required to produce spark.



wc_gr002884

4.10 Setting Air Gap

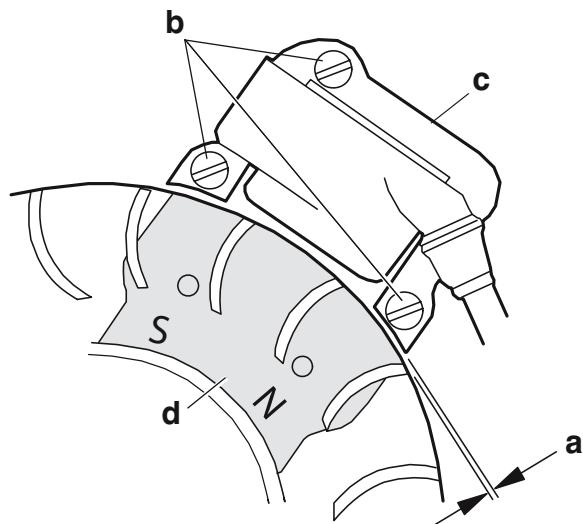
See Graphic: *wc_gr002885*

Newer engines use guide sleeve pins to automatically set the air gap; however, older models still require the proper air gap to be set manually. If the air gap is set incorrectly, the engine may be hard to start or it may run erratically. Check the air gap (**a**) with a feeler gauge and if the gap is not set at 0.4 mm (0.013–0.016 in.) the air gap needs to be reset.

To set the air gap:

- 4.10.1 Loosen the three screws (**b**) holding the ignition module (**c**) to the crankcase.
- 4.10.2 Rotate the flywheel until the magnet (**d**) is positioned directly under the module.
- 4.10.3 Insert a feeler gauge between the module and the flywheel and move the module until the correct gap is set. Torque the screws to 3.5 Nm (2.5 ft.lbs.).

NOTICE: Do not overtighten the screws on the module or the threads in the engine housing may be damaged.



wc_gr002885

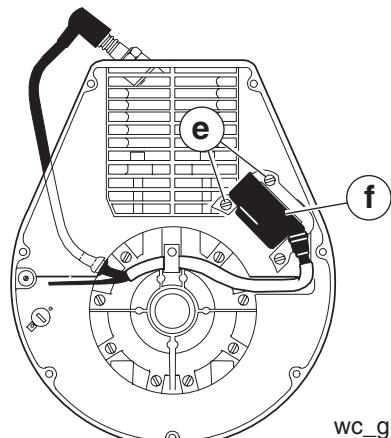
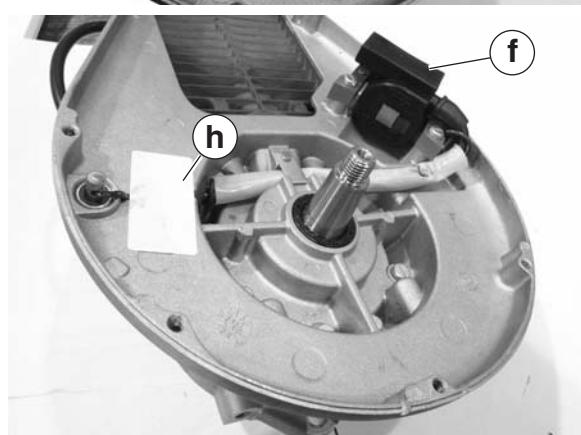
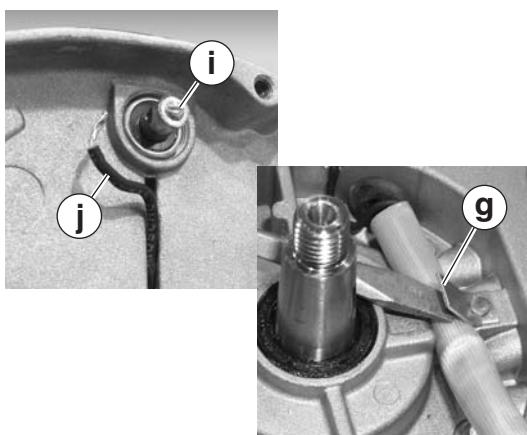
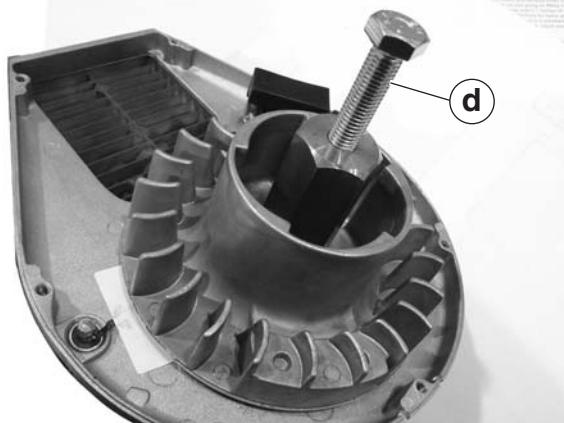
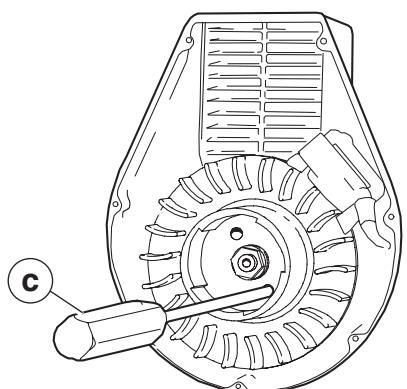
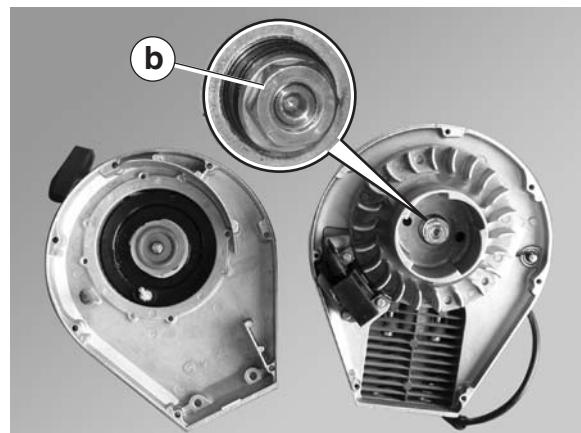
4.11 Replacing the Ignition Module

See Graphic: *wc_gr002886*

Removal:

The engine does not have to be removed from the machine to replace the ignition module.

- 4.11.1 Disconnect the ignition wire from the spark plug.
- 4.11.2 Remove the seven M5 screws **(a)** which secure the flywheel housing to the crankcase. **Note:** *The screws may require heat to loosen.* Separate the flywheel housing from the crankcase.
- 4.11.3 When removing the M12 nut **(b)**, it is recommended that an impact wrench be used. An alternative is to insert a screwdriver **(c)** into one of the two holes in the starter cup to prevent the flywheel from turning. Then, use a 19 mm socket and turn the M12 nut counterclockwise to remove it from the crankshaft. Also remove the washer under the M12 nut.
- 4.11.4 Thread flywheel puller P/N 46503 **(d)** completely onto the threaded shaft of the flywheel. Turn the pusher screw portion of the puller until it engages with the crankshaft. Continue turning the pusher screw until the flywheel is free from the tapered shaft of the crankshaft. **Note:** *The flywheel may “pop” at the moment it is free from the crankshaft.* Remove the flywheel puller and remove the flywheel.
- 4.11.5 Remove the key from the crankshaft.
- 4.11.6 Remove the screws **(e)** which secure the ignition module **(f)** to the crankcase.
- 4.11.7 Bend the retaining tab **(g)** to allow the ignition wire to be removed from the housing.
- 4.11.8 Remove the sticker **(h)** which keeps the wires in the groove of the flywheel housing.
- 4.11.9 Loosen the screw **(i)** which secures the ground wire to the stop switch and remove the ground wire **(j)** from the stop switch. Then, pull the ground wire through the wire harness.
- 4.11.10 Unscrew the ignition wire **(k)** from the ignition module and remove the ignition module.
- 4.11.11 Pull the ignition wire from the crankcase.

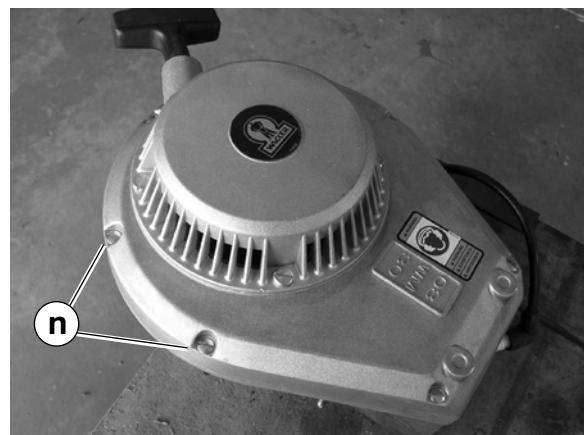
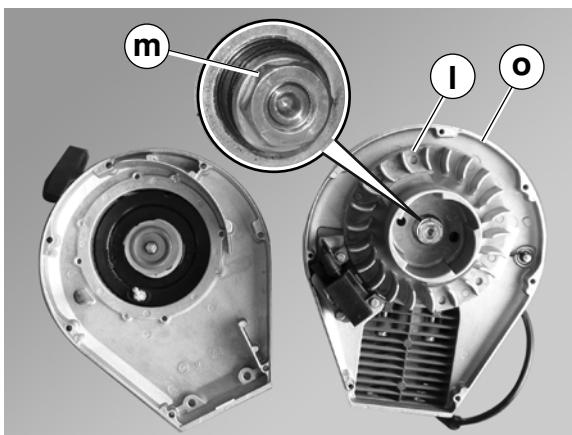
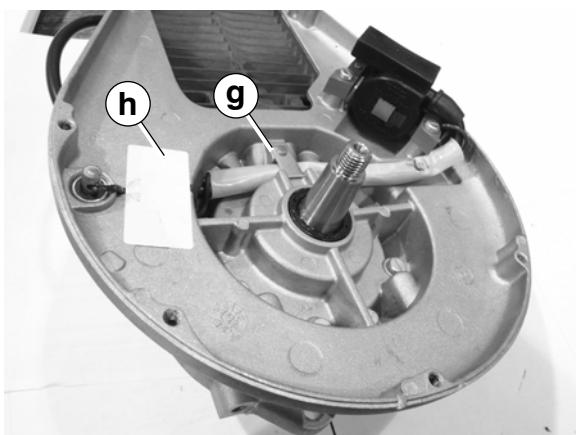
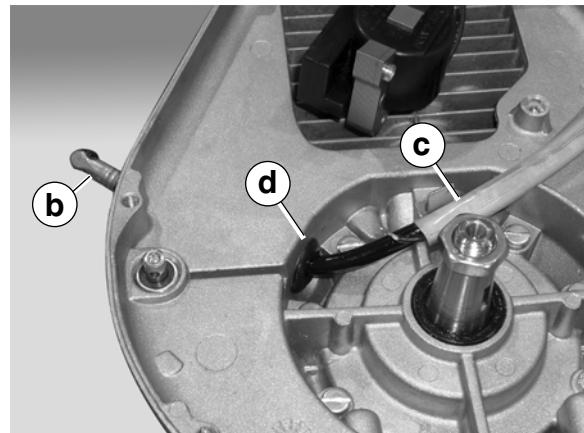
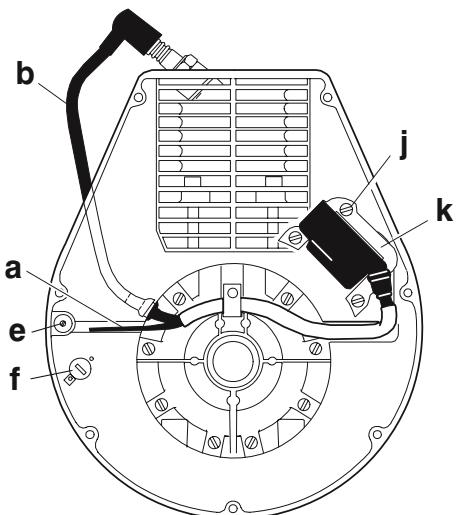


wc_gr002886

See Graphic: *wc_gr002887*

Installation:

- 4.11.12 Apply a light coating of oil to the ground **(a)** and ignition wires **(b)** and slide them through the protective sleeve **(c)**.
- 4.11.13 Slide the ignition wire through the boot **(d)** in the side of the crankcase.
- 4.11.14 Secure the ground wire to the stop switch **(e)**. (Older models use a terminal flag **(f)**.) Tuck the ground wire within the groove of the crankcase.
- 4.11.15 Position the wire sleeve underneath the holding tab **(g)** and bend the tab down to hold the wires and sleeve in place.
- 4.11.16 Clean the area of the crankcase around the ground wire and apply a new white label **(h)** to the crankcase.
- 4.11.17 Attach the spark plug cap **(i)** to the ignition wire.
- 4.11.18 Apply Loctite 243 or equivalent to three M8 slot head screws **(j)** and using the screws, secure the ignition module **(k)** to the crankcase. Torque screws to 3.4 Nm (2.5 ft.lbs.). For those engines requiring manual air gap adjustment, adjust the ignition module air gap. See section *Setting Air Gap*.
- 4.11.19 Insert the key into the crankshaft. Secure the flywheel **(l)** to the crankshaft with washer and M12 nut **(m)**. Torque the nut to 50 Nm (41 ft.lbs.).
- 4.11.20 Check for spark. See section *Checking Spark*.
- 4.11.21 Apply Loctite 243 or equivalent to seven M5 screws **(n)** and using the screws, secure the flywheel housing to the crankcase.



wc_gr002887

5 Carburetor Basics

5.1 Brands Used

See Graphic: *wc_gr005089*

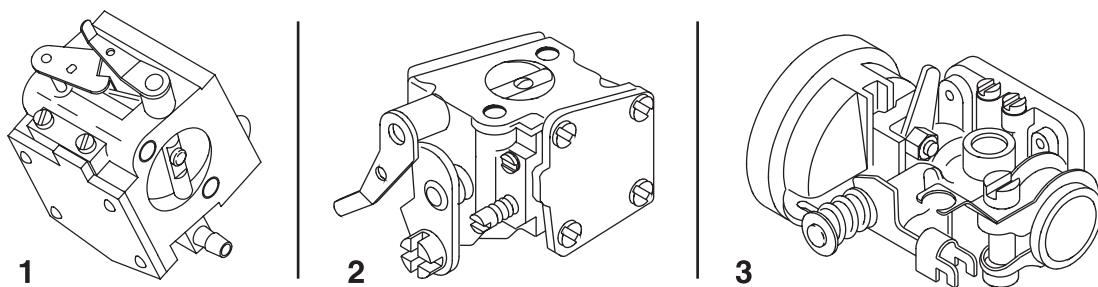
Three brands of carburetors are used on the WM 80 engine: Walbro (1), Tillotson (2), and Bing (3).

The Walbro and Tillotson carburetors have internal fuel pumps while the Bing uses gravity feed to supply the fuel from the tank to the engine. With the Bing carburetor, the fuel tank must be located above the carburetor for the fuel feed to work properly. The fuel pumps on Walbro and Tillotson carburetors operate on differences in air pressure between the atmosphere and the crankcase. No matter the design, the carburetors can be used at different angles and are very tolerant of high vibration.

As of the publishing of this manual, only one version of the Walbro carburetor has been used. It is a fixed jet design. It features an air purge system.

Three different versions of the Tillotson carburetor have been used: Dual Needle, Single Needle, and Fixed Jets With Primary Idle Bypass. See section *Tillotson Carburetor Versions*.

Two different versions of the Bing carburetor have been used: one with a metal inlet control lever and a plastic choke, and another with a fixed plastic inlet control lever and a metal choke.



wc_gr005089

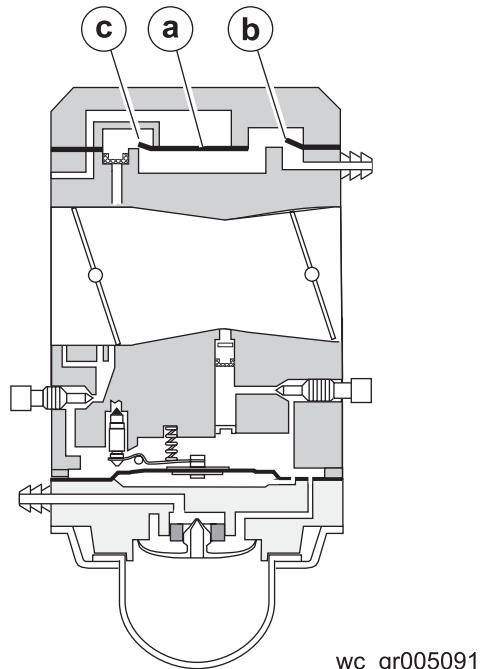
5.2 Walbro Carburetor Operation

Fuel Pump

The fuel pump is made up of a diaphragm (**a**) and a series of check valves (**b** & **c**). The power to operate the fuel pump comes from the crankcase impulse.

As the engine's piston moves up into the cylinder it creates a low-pressure area in the crankcase. The vacuum pulse travels through the impulse passage and draws up on the pump diaphragm creating a vacuum within the fuel chamber. Atmosphere pressure in the fuel tank pushes the fuel through the fuel filter and fuel line. The vacuum opens the inlet check valve (**b**) and allows fuel to fill the fuel chamber. The vacuum also closes the outlet check valve (**c**).

As the piston moves down into the crankcase it pressurizes the air. The pressurized air travels through the impulse passage into the carburetor fuel pump. It pushes on the diaphragm pressurizing the fuel. The pressurized fuel closes inlet check valve opens the outlet check valve. Fuel flows to the inlet screen and to the inlet needle and the fuel metering system.

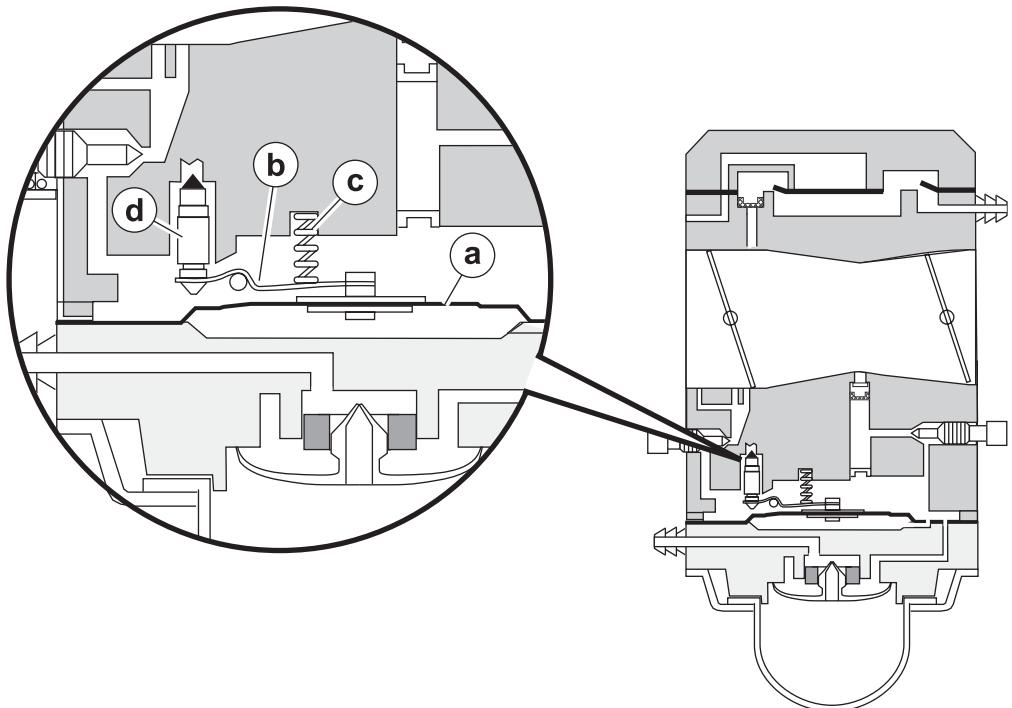


wc_gr005091

Fuel Metering

There are four components of the fuel metering system: the metering diaphragm (a), the metering lever (b), the spring (c), and the inlet needle (d).

The metering lever transfers the pressure of the spring to the inlet needle, holding the inlet needle closed and preventing fuel flow. When the metering diaphragm senses a vacuum pulse from the engine, it moves inward toward the carburetor. This action moves the metering lever, which in turn, lifts the inlet needle and allows fuel to flow into the metering chamber.

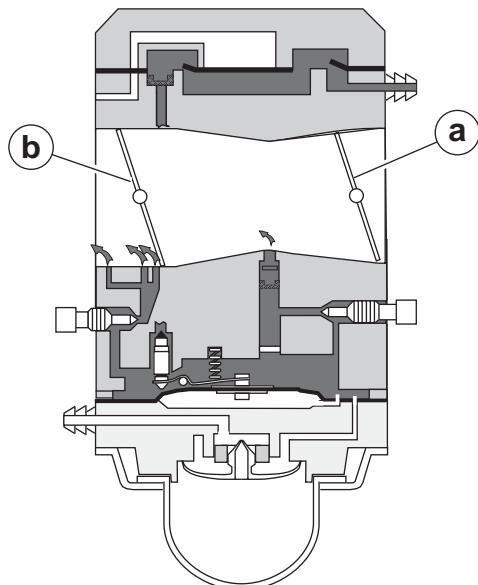


wc_gr005108

Start up

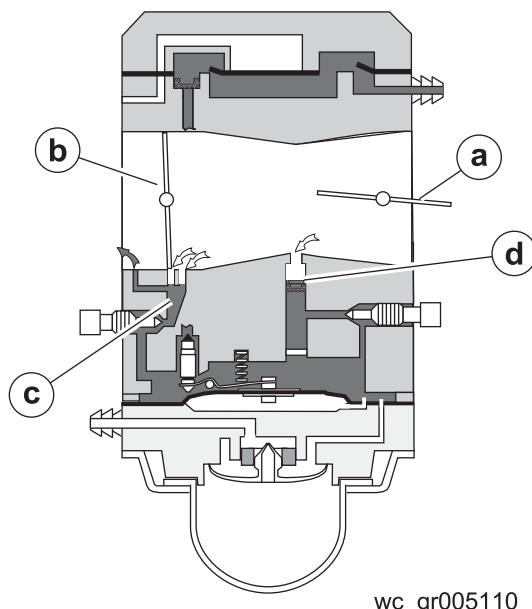
A rich fuel-to-air mixture is required at startup because of the lower cranking speed (compared to running) which causes less air flow, and the fact that the engine is usually cold. (A cold engine is not efficient at vaporizing fuel because heat is required to vaporize liquid.)

The above two conditions can be overcome by closing the choke (**a**) and opening the throttle (**b**) slightly. This creates a high vacuum within the carburetor's throat which causes all fuel nozzles to deliver fuel into the intake air stream.



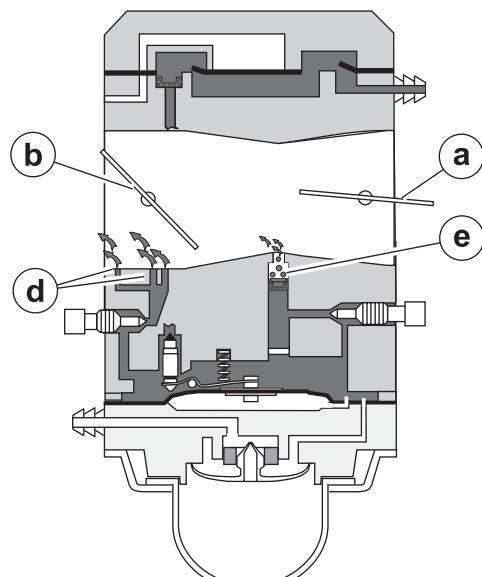
Idle

Once the engine starts, the choke (a) is opened and the throttle (b) nearly closed. The engine is at the idle state. During idle, low pressure exists on the engine side of the throttle and atmosphere pressure (high) on the other. Atmosphere air enters the fuel nozzles (transition holes) and mixes with the fuel in the idle pocket (c). Fuel is drawn out of the idle pocket on the engine side of the throttle and into the engine. Atmosphere pressure presses on the metering diaphragm which opens the needle valve to keep a supply of fuel in the lower chamber. A check valve (d) in the main nozzle prevents atmosphere air from entering the fuel passages.



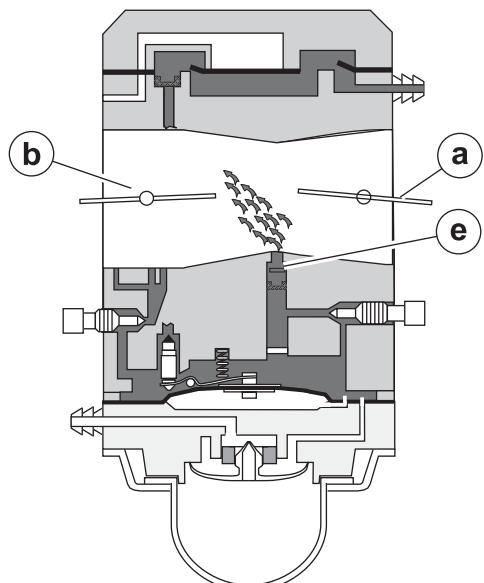
Partial Throttle Operation

At partial throttle, the choke (a) remains in the open position and the throttle (b) is partially opened. During partial throttle, low pressure exists on the engine side of the throttle plate. The low pressure draws fuel from the three progression fuel nozzles (d). As low pressure begins to fill the carburetor throat, the check valve starts to open and fuel begins to flow from the main nozzle (e).



Wide-Open Throttle Operation

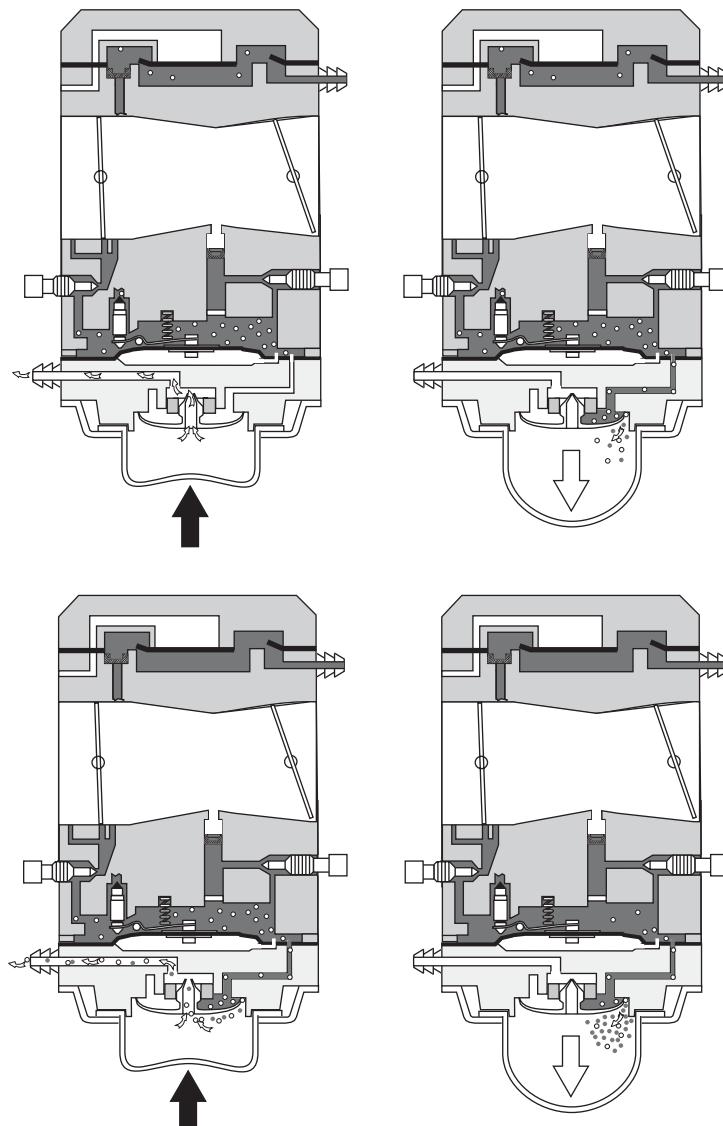
At wide-open throttle, the choke (a) remains in the open position and the throttle (b) is wide open. During this state, the throttle plate has little affect on high- and low-pressure areas within the carburetor throat. The venturi of the carburetor throat now takes over to create the low-pressure area. The low pressure created by the venturi draws fuel into the air stream. It also acts on the metering diaphragm which opens the needle valve to its furthest-open position, allowing supply fuel into the lower chamber. Fuel now flows from the main nozzle (e) located within the venturi. Very little fuel flows from the idle nozzles.



Air Purge System

The Walbro carburetor has an air purge system. The air purge system removes air from the fuel passages so that only fuel fills the carburetor and the fuel lines.

The heart of the air purge system is the bulb. The bulb works in conjunction with a number of check valves. Pressing the bulb forces air (and fuel) through the discharge port back to the tank. Releasing the bulb creates a vacuum within the fuel passages and sucks air (and fuel) into the bulb. The metering diaphragm is also pulled by the suction. This pulls the inlet needle from its seat and allows air (and fuel) to move from the pumping chamber into the metering chamber. This air (and fuel) is then expelled by pressing the bulb. Pressing the bulb until it is filled with only fuel, the purging process is complete.



wc_gr005113

5.3 Versions of Tillotson Carburetor

See Graphic: *wc_gr002889*

1) Dual Needle

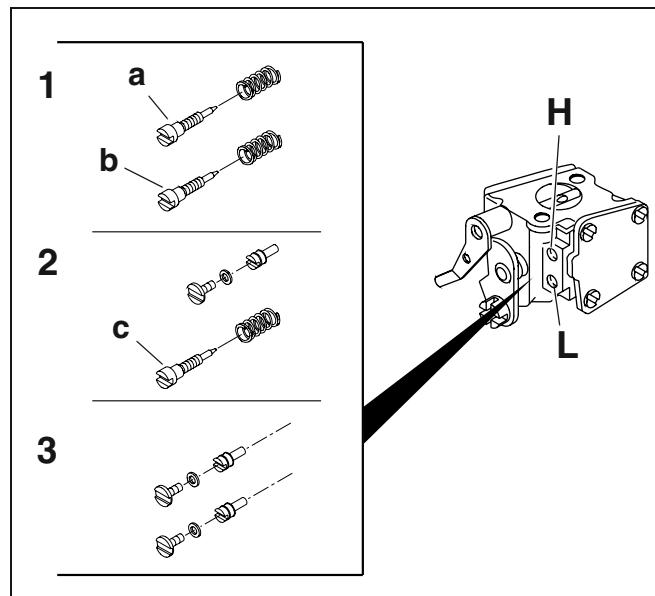
Dual needle carburetors have mixture needle valves that are adjustable. One of the valves (**a**) adjusts the high-speed jet (**H**) and the other valve (**b**) adjusts the low-speed jet (**L**). The needle valves operate by increasing or decreasing the size of the fuel passage to the discharge ports.

2) Single Needle

Single needle carburetors use a fixed, high-speed fuel jet. No adjustment of this jet can be made. A low-speed-mixture needle valve (**c**) is used to adjust the low-speed jet (**L**) which controls the idle mixture and the idle speed. The needle valve operates by increasing or decreasing the size of the fuel passage to the discharge ports.

3) Fixed-jet, Primary-idle-bypass

Fixed-jet, primary-idle-bypass versions use fixed high-speed and fixed low-speed jets. No adjustment of either jet can be made. A separate bypass circuit provides the air/fuel mix to run the engine at idle.



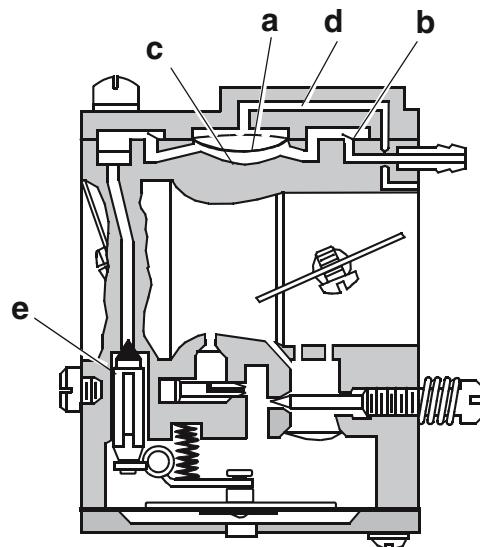
wc_gr002889

5.4 Tillotson Carburetor Operation

See Graphic: *wc_gr002891*

Fuel Pump:

The Tillotson carburetor uses a flexible diaphragm fuel pump (a) to operate an inlet valve (b) which controls fuel flow to the carburetor fuel reservoir (c). The fuel pump operates by reacting to pressure changes in the engine crankcase transmitted through an impulse line (d). The impulse line can be external (connected to the crankcase through a plastic tube), or internal to the carburetor (connected through an orifice drilled in the carburetor adapter) depending on carburetor version. During the compression stroke, the vacuum created in the crankcase is transmitted to the carburetor through the impulse line. The vacuum pulls the fuel pump diaphragm upward. The upward movement of the diaphragm creates a vacuum in the fuel reservoir which opens the fuel inlet valve and draws fuel into the fuel reservoir. During the engine's power stroke, positive crankcase pressure, also transmitted through the impulse line, pushes the diaphragm down. The downward movement of the diaphragm closes the inlet valve and forces fuel toward the inlet needle valve (e).

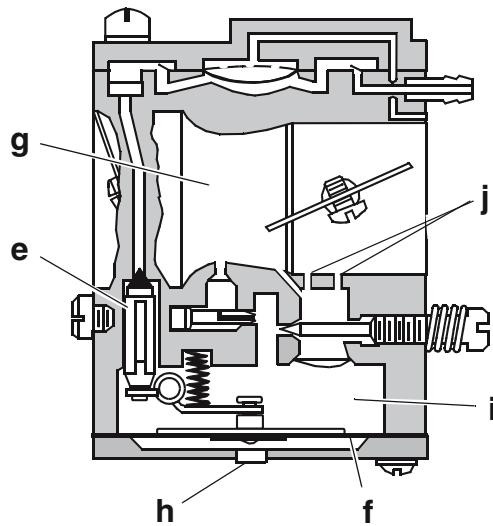


wc_gr002891

See Graphic: *wc_gr002892*

Inlet Needle Valve:

The inlet needle valve (**e**) controls fuel flow into the fuel chamber. This valve is operated by a second diaphragm called the control diaphragm (**f**). The control diaphragm is activated by the vacuum created when air moves past the venturi (**g**) of the carburetor throat. A vent (**h**) to the atmosphere provides the air pressure differential needed to create the vacuum. The vent can be direct to outside the carburetor or it may be upstream of the discharge ports through an orifice drilled in the carburetor body. The vacuum draws the control diaphragm towards the carburetor throat and in turn opens the inlet needle valve allowing fuel into the fuel chamber (**i**). Suction at the engine intake draws fuel out of the fuel chamber through the discharge ports (**j**) into the carburetor throat. As the fuel in the chamber is used up, atmospheric pressure pushes in on the opposite side of the diaphragm pushing it towards the throat of the carburetor. This diaphragm action lowers the inlet needle valve and allows fuel to fill the fuel chamber. The fuel pushes the diaphragm away from the carburetor throat and in turn closes the inlet needle valve. In actual practice, the inlet needle valve assumes an averaging position where the amount of fuel entering exactly replaces the amount being used.

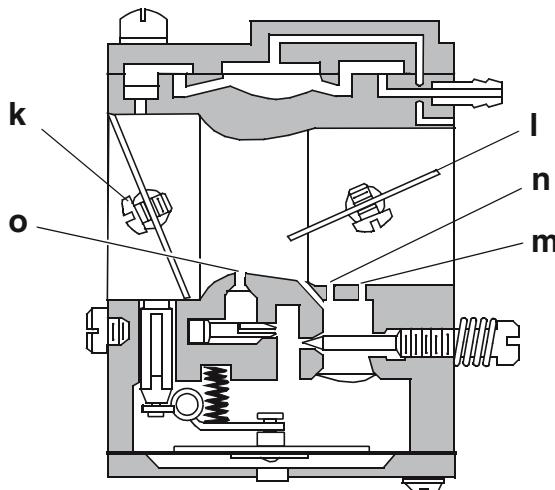


wc_gr002892

See Graphic: *wc_gr002893*

Start-up mode (choke):

During cold start-up, the choke shutter (butterfly) (**k**) is closed and the throttle shutter (**l**) is partially open. As the engine is turned over, engine suction draws fuel from the primary (**m**), secondary (**n**), and main fuel (**o**) discharge ports. Since the choke is closed, the amount of air flowing through the carburetor is very restricted. As a result, a rich fuel mixture (fuel mixed with a relatively small amount of air) is delivered to the engine which allows the engine to start more readily than a lean mixture.



wc_gr002893

See Graphic: *wc_gr002894*

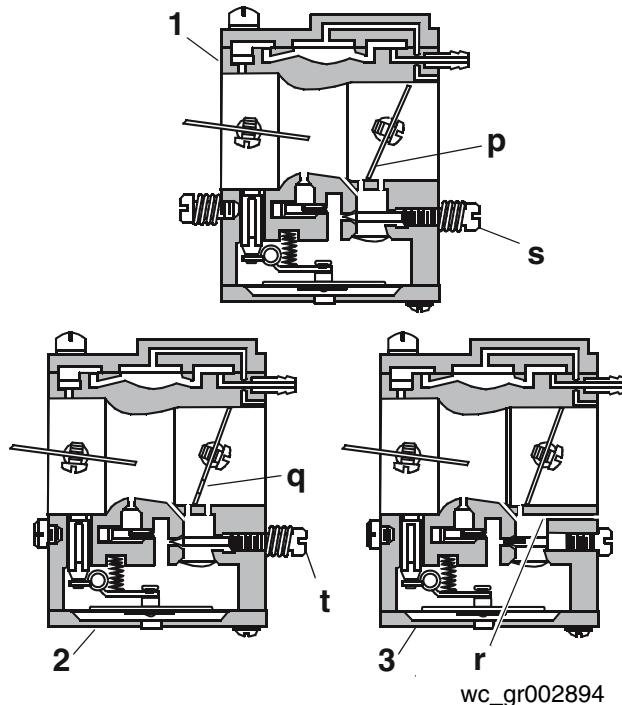
Idle Speed:

At idle speed, only a small amount of air flow through the carburetor is required. The air flow is regulated by the throttle shutter alone because the choke is open. However, the throttle shutter regulates the air flow differently, depending on the version of the carburetor used.

In dual-needle versions (**1**), the throttle shutter (**p**) is adjusted by an idle speed screw. The idle speed is also regulated by the slow speed mixture needle valve (**s**). By turning the valve, the fuel/air mixture can be made richer or leaner, affecting the engine's speed (rpm).

In single-needle versions (2), the throttle shutter does not open and there is no idle speed screw; instead, a small hole (q) in the shutter regulates the air flow. The idle speed is also regulated by the slow speed mixture needle valve (t). By turning the valve, the fuel/air mixture can be made richer or leaner, affecting the engine's speed (rpm).

In fixed-jet, primary-idle-bypass versions (3), a separate port (r) leads from the fuel chamber through the carburetor adapter, through a short hose, then directly into the engine crankcase. The fuel/air mix traveling through this line keeps the engine running at idle. An idle speed screw is then used to adjust the throttle shutter and fine-tune the engine speed.



See Graphic: *wc_gr002895*

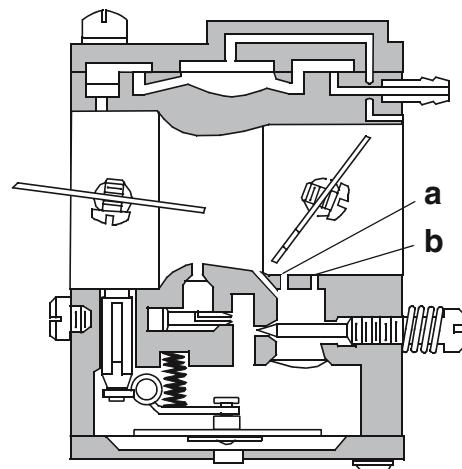
Partial Throttle:

At partial throttle, the throttle shutter is partially opened, allowing a greater amount of air through the carburetor. The throttle has opened wide enough to expose the secondary idle discharge port (a) which provides more fuel to mix with the air.

In dual-needle versions, engine suction draws fuel from both the primary **(b)** and secondary idle discharge ports. As at idle, the slow speed mixture needle valve regulates the engine speed. By turning the valve, the fuel/air mixture can be made richer or leaner, affecting the engine's speed (rpm).

In single-needle versions, engine suction also draws fuel from both the primary (**b**) and secondary idle discharge ports. And like dual needle carburetors, the adjustable mixture needle valve regulates the engine speed. By turning the valve, the fuel/air mixture can be made richer or leaner, affecting the engine's speed (rpm).

In fixed-jet, primary-idle-bypass versions, only the secondary discharge port provides fuel at partial throttle. Both high- and low-speed jets are fixed; no adjustments to jets can be made.



wc_gr002895

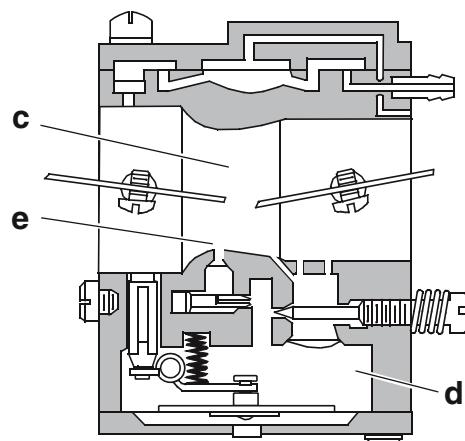
See Graphic: *wc_gr002896*

Full Throttle:

The wider the throttle shutter opens, the more air that will flow through the carburetor. As the air reaches the venturi (**c**), it is forced to flow faster to keep the same volume of air flowing. The faster the air flows through the venturi, the lower the air pressure in the venturi becomes. When the air pressure becomes lower than the pressure (atmospheric) on the fuel in the fuel chamber (**d**), fuel will flow out through the main discharge port (**e**) into the throat of the carburetor. The fuel mixes with the air stream, flows through the carburetor adapter, and into the engine crankcase.

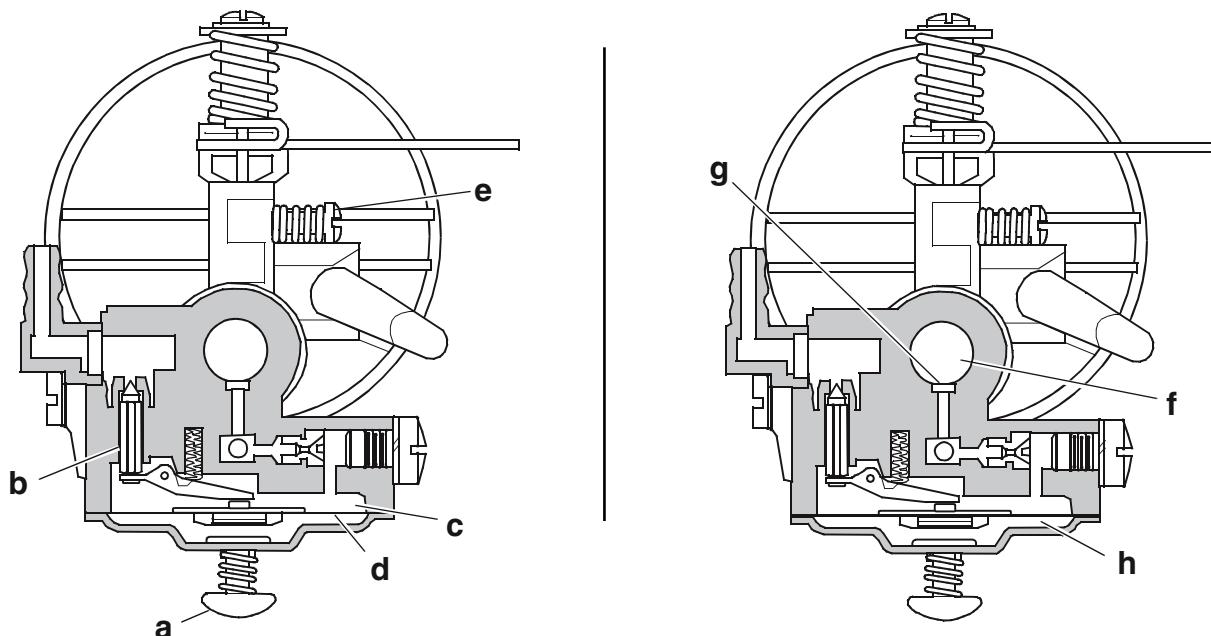
In summary, the wider the throttle is open, the faster the air will flow. The faster the air flows, the lower the air pressure. The lower the air pressure, the more fuel that will flow out. The more fuel that flows out, the faster the engine runs. This phenomenon is true at any speed and allows the carburetor to maintain the same approximate fuel-to-air ratio as the throttle shutter (flow of air) varies.

The fuel will also flow out of the secondary discharge port and, in dual- and single-needle versions, out of the primary idle port as well.



wc_gr002896

5.5 Bing Carburetor Operation



wc_gr002897

See Graphic: *wc_gr002897*

Fuel Feed:

The Bing carburetor does not use a fuel pump; instead, the fuel supply is gravity fed. A priming button (**a**) is used during the initial start-up to manually open the inlet needle valve (**b**) which primes the fuel chamber (**c**).

Inlet Needle Valve:

While the engine is running, fuel flow into the fuel chamber is controlled by the inlet needle valve. The inlet needle valve is operated by the control diaphragm (**d**). The control diaphragm is activated by the vacuum created when air moves through the carburetor throat. A vent to atmosphere provides the air pressure differential needed to create the vacuum. This vacuum draws the control diaphragm towards the carburetor throat and in turn opens the inlet needle valve allowing fuel into the fuel chamber. Suction at the engine intake draws fuel out of the fuel chamber, through the discharge ports into the carburetor throat. As the fuel in the chamber is used up, atmospheric pressure pushes in on the opposite side of the diaphragm pushing it towards the throat of the carburetor. This diaphragm action lowers the inlet needle valve and allows fuel to fill the fuel chamber. This fuel pushes the diaphragm away from the carburetor throat and in turn closes the inlet needle valve. In actual practice, the inlet needle valve assumes an averaging position whereby the amount of the fuel entering exactly replaces the amount being used.

Partial Throttle:

At partial throttle, the throttle shutter is partially opened allowing a greater amount of air through the carburetor. The throttle has opened wide enough to expose the secondary-idle discharge port and the engine suction draws fuel from both the primary-idle and secondary-idle discharge ports.

Idle and Low Speed:

The amount of air flowing through the carburetor is regulated by the throttle and choke shutters. At idle, only a small amount air flow is needed. This air flow is regulated by the throttle shutter alone, because the choke is open and no longer affects air flow. Idle speed can be adjusted by the idle speed screw (**e**).

Start-up Mode (Choke):

During cold start-up, the choke shutter (butterfly) is closed and the throttle shutter is partially open. As the engine is turned over, engine suction draws fuel from the primary, secondary, and main fuel discharge ports. Because the choke is closed, the amount of air flowing through the carburetor is very restricted. As a result, a rich fuel mixture (fuel mixed with a relatively small amount of air) is delivered to the engine which allows the engine to start more easily.

Full Throttle:

As the throttle continues to open, the velocity of the air through the carburetor venturi (**f**) increases and creates a low pressure area over the main fuel discharge port (**g**). When the air pressure in the venturi becomes lower than the pressure on the fuel in the fuel chamber (**h**), the fuel will flow out into the throat of the carburetor and mix with the air stream. The fuel will also flow out of the primary and secondary discharge ports. The wider the throttle is opened, the more air that will flow through the carburetor. The more air flowing, the faster it will flow over the venturi. The faster over the venturi, the lower the pressure over the main discharge port and thus the more fuel which will flow out into the air stream. This phenomenon allows the carburetor to maintain the same approximate air/fuel ratio as the air flow varies.

Notes

5.6 Carburetor Adapters

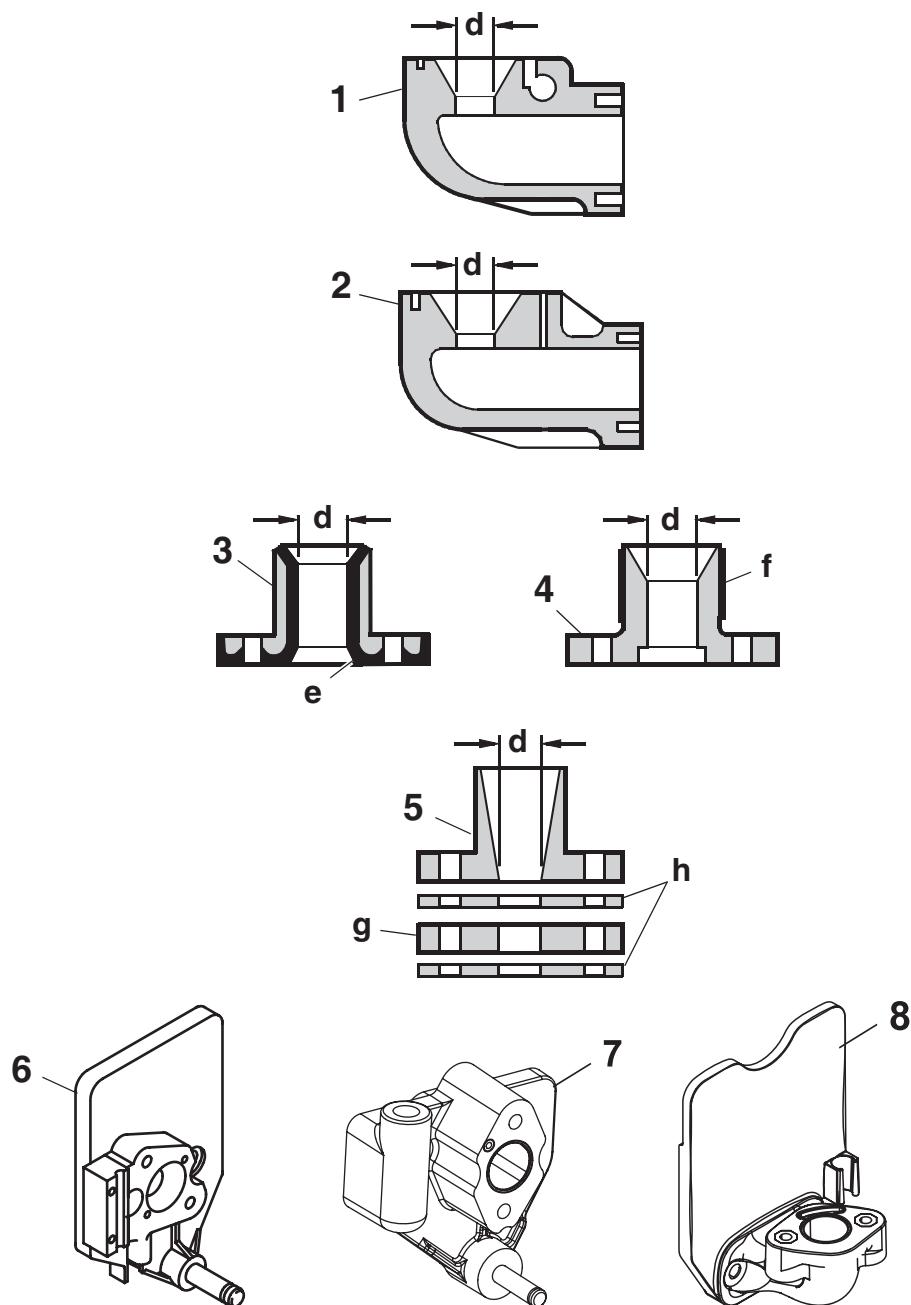
See Graphic: *wc_gr007414*

The function of the carburetor adapter is to control the amount of fuel/air mixture that can reach the engine. When used in combination with the carburetor fuel jets, the power and speed of the engine is controlled. This allows the WM 80 engine to adapt to the power and speed requirements of different machine models.

No matter the style, all adapters control the fuel/air mixture through bore diameter (**d**) size. Each application calls for a specific adapter and it is important that the correct adapter be used. Consult the parts book for the proper one.

NOTICE: Using the wrong adapter may cause the engine to overspeed or lose power, resulting in excessive engine wear and reduced performance.

1. This plastic, elbow-style adapter is used with Tillotson carburetors that have fixed mixture needle valves with primary-idle-bypass circuit. This adapter is used on rammers.
2. This plastic, elbow-style adapter is used with Tillotson carburetors that have single- or dual-mixture needle valves. This adapter is used on rammers.
3. This straight-through-style adapter is used with both Bing and Tillotson carburetors that have single- or dual-mixture needle valves. It has an insulating layer (**e**) that helps retard heat transfer. This adapter is used on rammers, breakers, and vibroplates.
4. This plastic, straight-through-style adapter was used with both Bing and Tillotson carburetors. The carburetor mounts to a metal band (**f**) embedded in the shaft of the adapter. This adapter was used on rammers, breakers, and vibroplates.
5. This metal, straight-through-style adapter was used with both Bing and Tillotson carburetors. An insulating spacer (**g**) and gaskets (**h**) are used in assembling this adapter to the engine. This adapter was used on rammers, breakers, and vibroplates.
6. This composite, straight-through-style adapter is used exclusively with Tillotson carburetors. It can be found on rammers.
7. This composite, straight-through-style adapter is used exclusively with Walbro carburetors. It can be found on rammers.
8. This elbow-style adapter is used with Walbro carburetors that utilize the auto-release choke. This adapter is used on rammers.



wc_gr007414

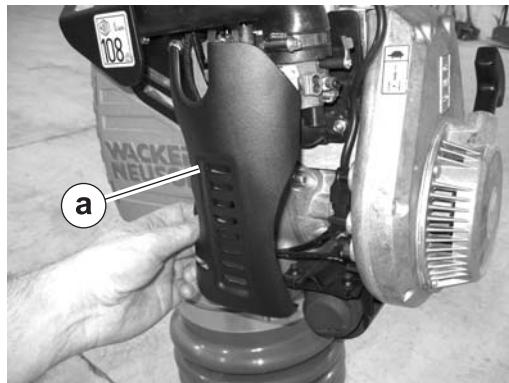
6 Carburetor Replacement

6.1 Replacing the Walbro Carburetor (auto-release choke models)

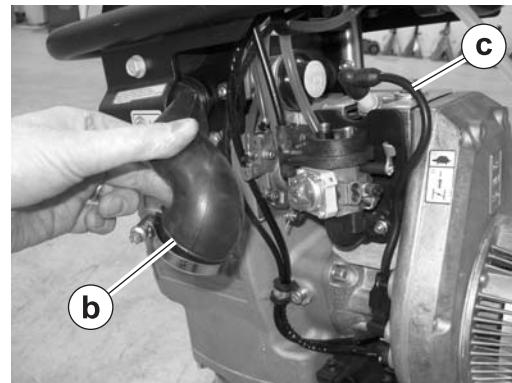
Removal

6.1.1 Stop the machine and allow it to cool.

6.1.2 Remove the carburetor guard (a).



wc_gr007416

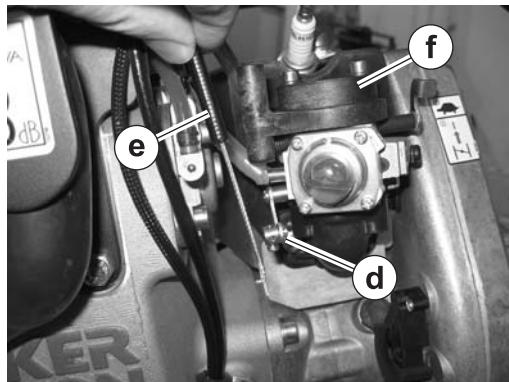


wc_gr007417

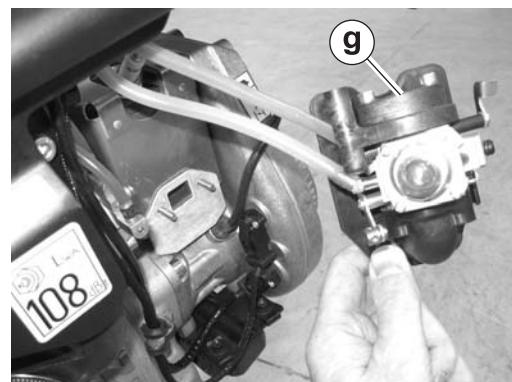
6.1.3 Loosen the hose clamp and remove the air duct (b).

6.1.4 Disconnect the ignition wire (c) from the spark plug.

6.1.5 Loosen the clamp (d) and remove the throttle cable (e) from the carburetor adapter (f).



wc_gr007418



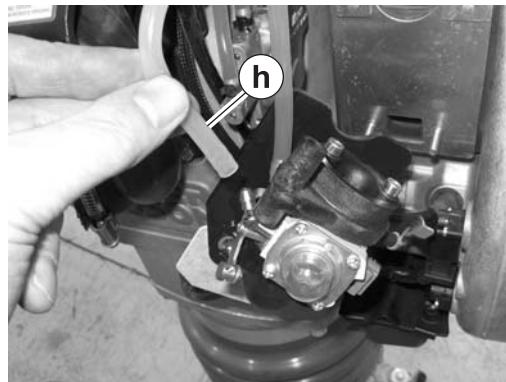
wc_gr007419

6.1.6 Remove the two nuts and washers and remove the carburetor assembly (g) from the machine.

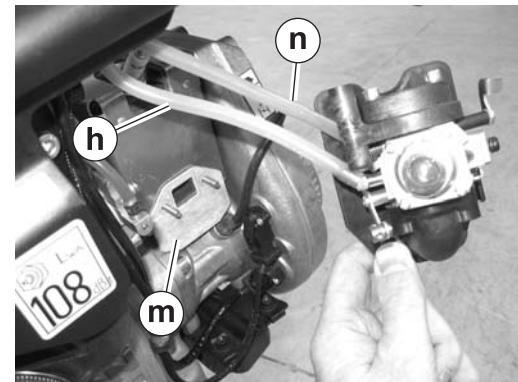
This procedure continues on the next page.

Continued from the previous page.

6.1.7 Have a container ready, then remove the oil hose (**h**) and drain it.



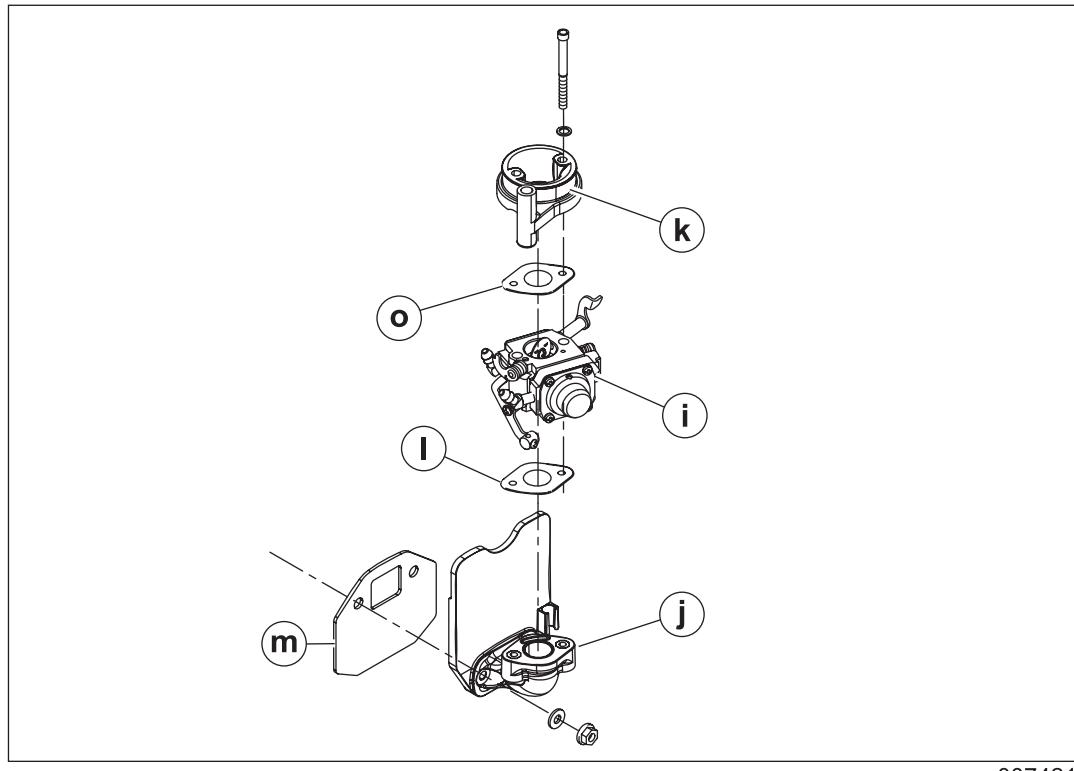
wc_gr007420



wc_gr007455

6.1.8 Make sure the throttle is in the OFF position. This position also closes the fuel valve. Then, remove the fuel hose (**n**) and drain it.

6.1.9 Remove the gasket (**m**).



wc_gr007421

6.1.10 Disassemble the carburetor (**i**) from the adapter (**j**), flange (**k**), and gaskets (**l** and **o**).

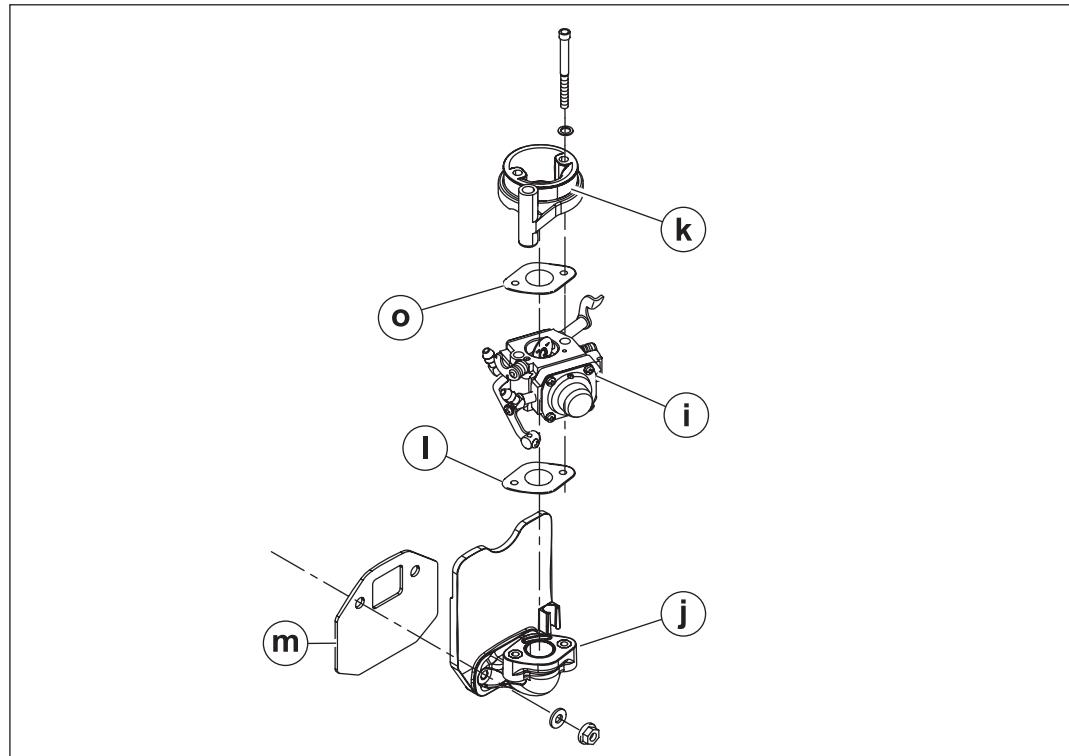
Result

The removal procedure is now complete.

Installation

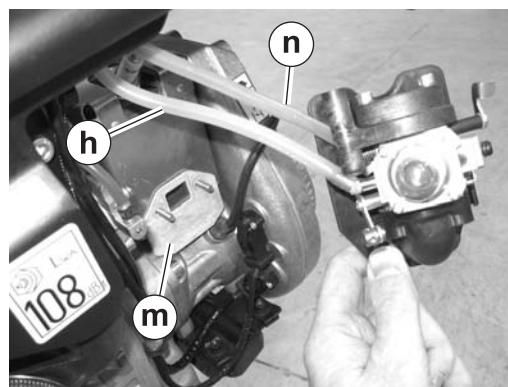
Perform the procedure below to install the carburetor

- 6.1.1 Assemble the adapter (**j**), lower gasket (**l**), flange (**k**), and upper gasket (**o**) to the carburetor (**i**). **Note:** The gaskets are not interchangeable.



wc_gr007421

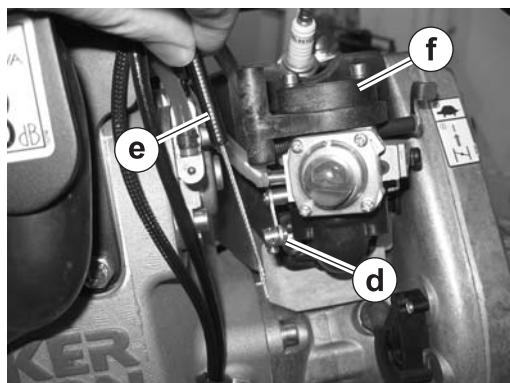
- 6.1.2 Connect the oil hose (**h**), and the fuel hose (**n**), to the carburetor.



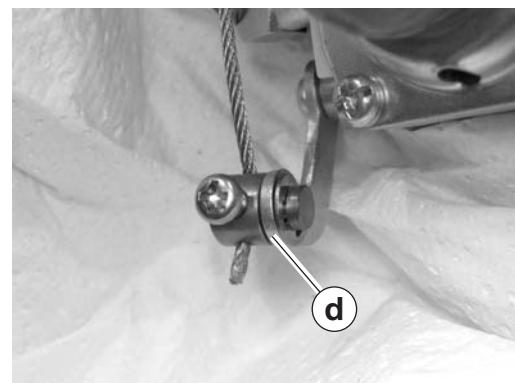
wc_gr007455

- 6.1.3 Install the carburetor assembly to the engine.

6.1.4 Slide the throttle cable (e) through the adapter (f) and reconnect it to the clamp (d).

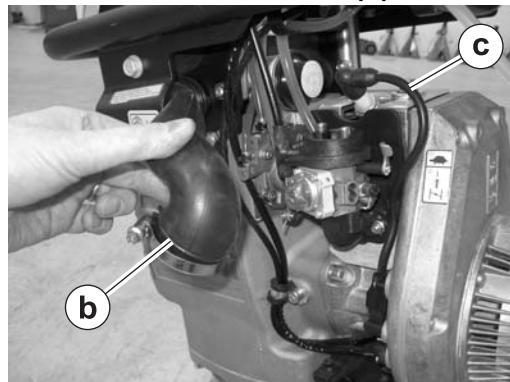


wc_gr007418

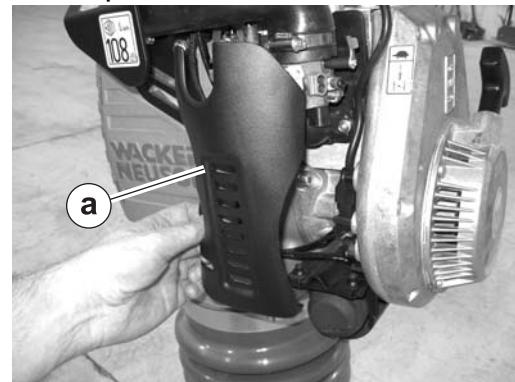


wc_gr007456

6.1.5 Install the air duct (b) with the hose clamp (c).



wc_gr007417



wc_gr007416

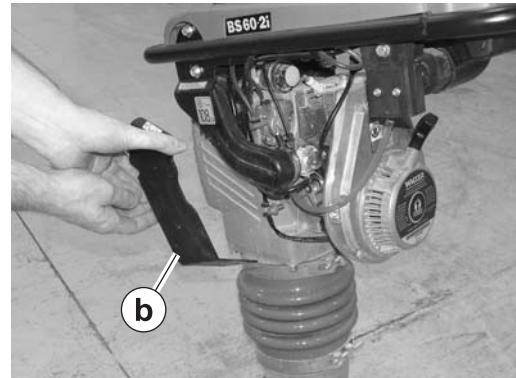
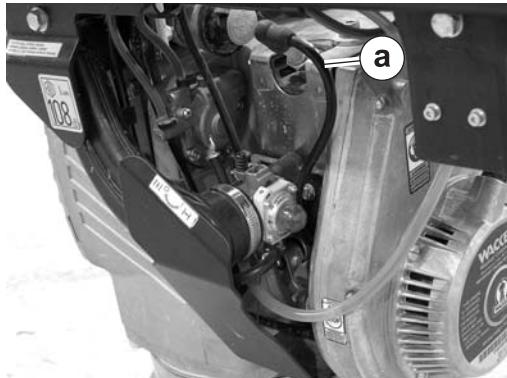
6.1.6 Using Loctite® 243 on the screws, install the carburetor guard (a).

Result

The installation procedure is now complete.

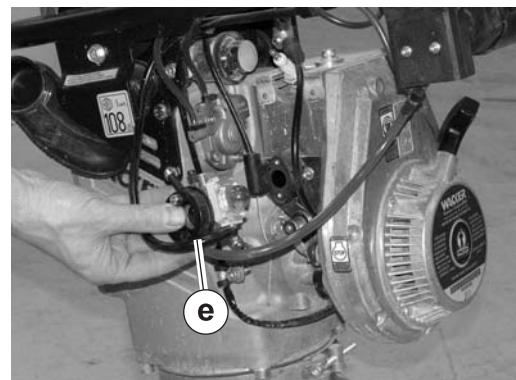
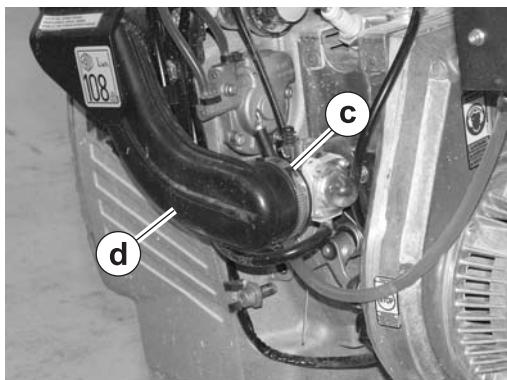
6.2 Removing Walbro Carburetor (standard choke models)

- 6.2.1 Stop the machine and allow it to cool.
- 6.2.2 Place the throttle in the OFF position.
- 6.2.3 Disconnect the ignition wire (a) from the spark plug.



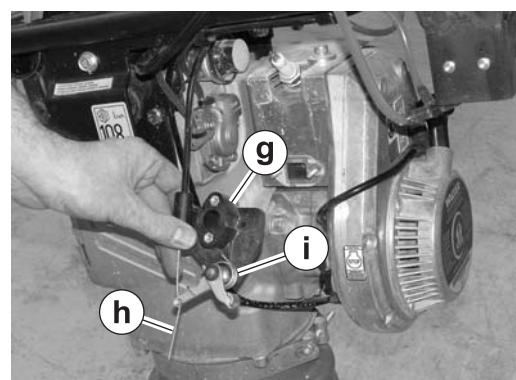
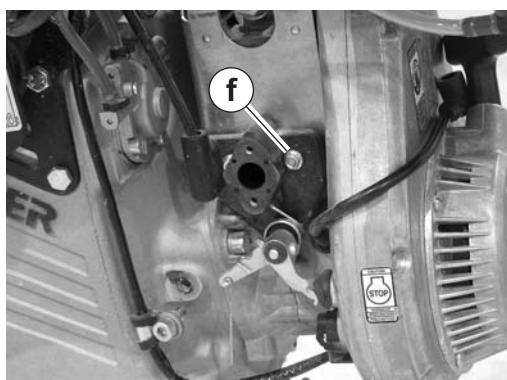
wc_gr005137

- 6.2.4 Remove the carburetor guard (b).
- 6.2.5 Loosen the hose clamp (c) and remove the air duct (d).



wc_gr005138

- 6.2.6 Remove the two screws and remove the flange (e) and the carburetor from the machine.
- 6.2.7 Remove the screws (f) and remove the adapter (g).



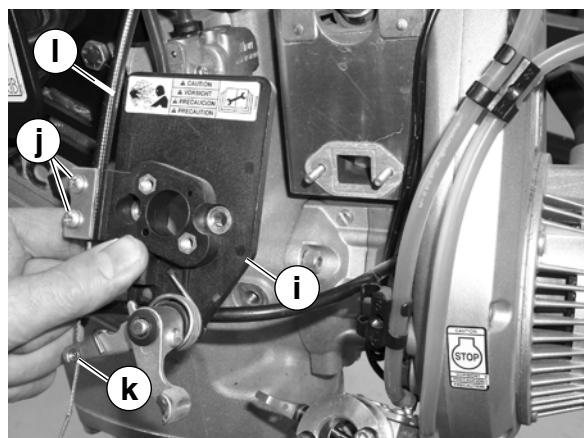
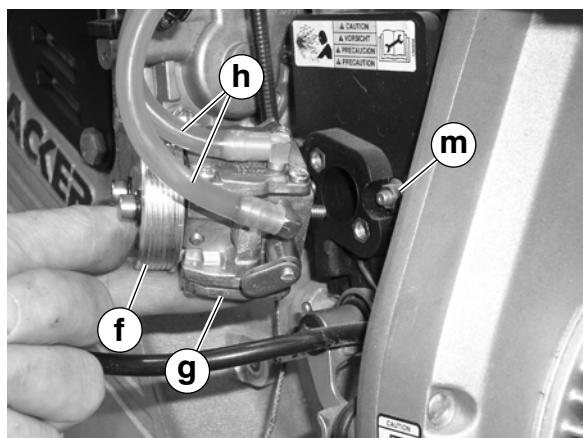
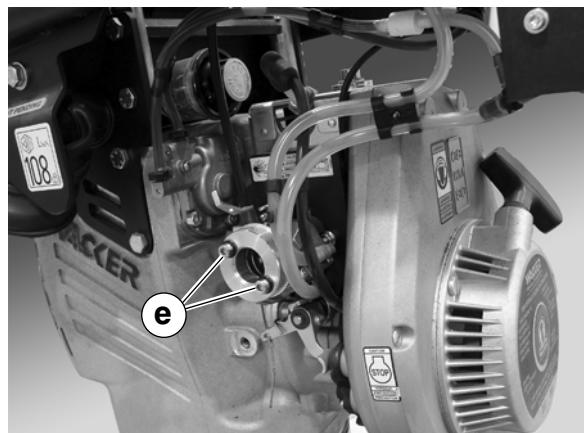
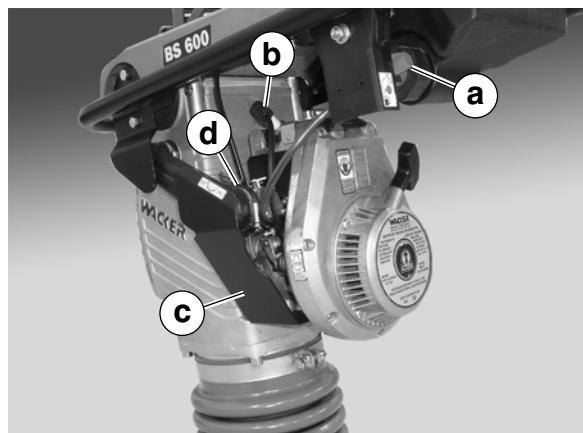
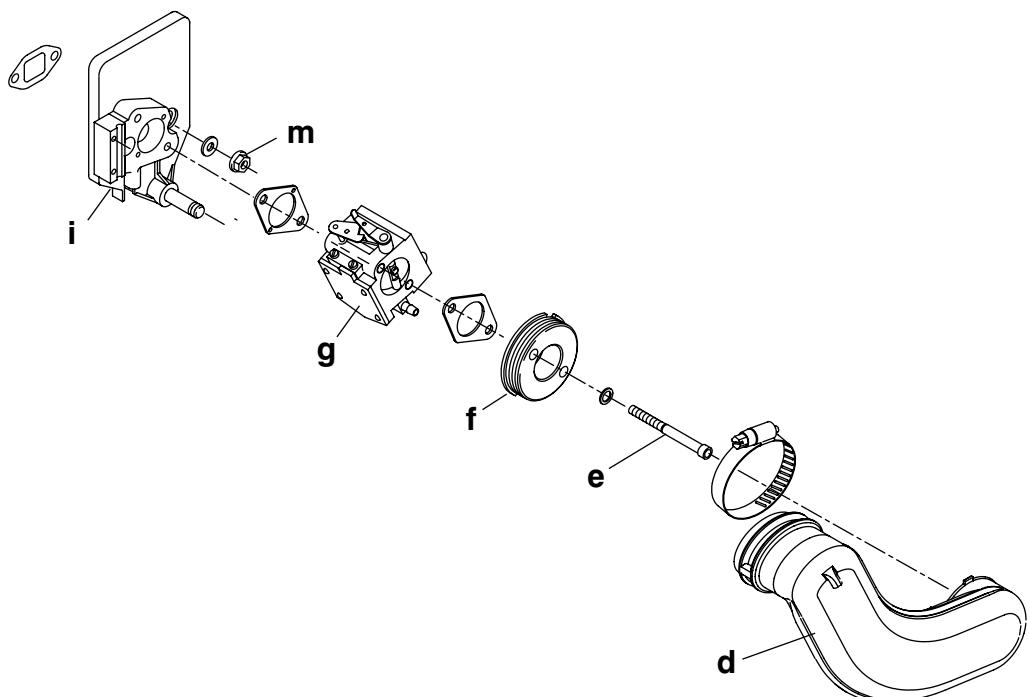
wc_gr005139

- 6.2.8 Disconnect the throttle cable (h). Remove the spring (i).

6.3 Removal, Tillotson with composite adapter

See Graphic: *wc_gr002929*

- 6.3.1 Stop the machine and allow it to cool.
- 6.3.2 Close the fuel valve **(a)** (if equipped).
- 6.3.3 Disconnect the ignition wire **(b)** at the spark plug.
- 6.3.4 Remove the carburetor guard **(c)**.
- 6.3.5 Loosen the clamps holding the air duct **(d)** to the carburetor and remove the air duct from the carburetor.
- 6.3.6 Remove the two socket head cap screws **(e)** holding the flange **(f)** to the carburetor **(g)** and remove both the flange and the carburetor.
- 6.3.7 Disconnect and plug the fuel line(s) **(h)** to the carburetor.
- 6.3.8 To remove the carburetor adapter **(i)**, loosen the two screws **(j)** and the nut **(k)** holding the throttle cable **(l)**. Then, remove the two nuts **(m)** and remove the carburetor adapter.

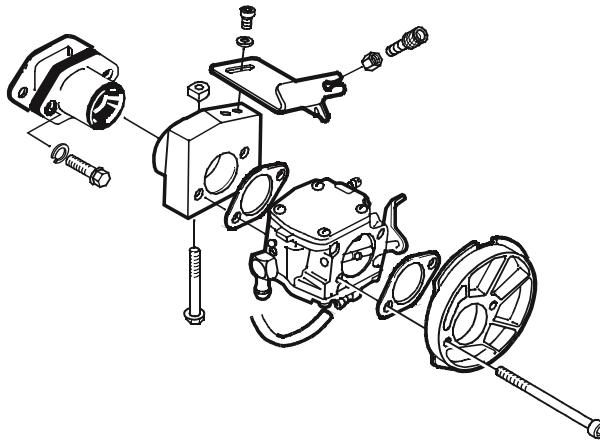


wc_gr002929

6.4 Tillotson with Straight-Through Adapters

See Graphic: *wc_gr002898*

- 6.4.1 Turn off the fuel valve at the tank and disconnect the spark plug lead wire.
- 6.4.2 Remove the air filter pipe (loosen both clamps).
- 6.4.3 Disconnect the throttle cable.
- 6.4.4 Loosen the clamp which secures the carburetor to the adapter and slide the carburetor off.
- 6.4.5 Protect the cylinder from dirt by cranking the engine until the piston is covering the intake port.

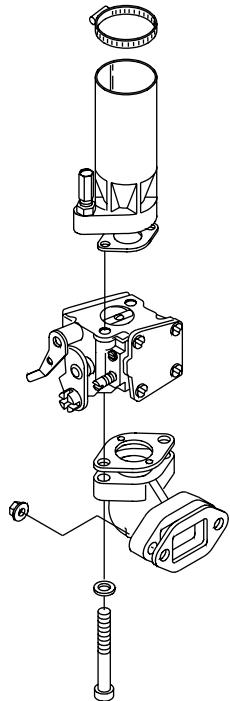
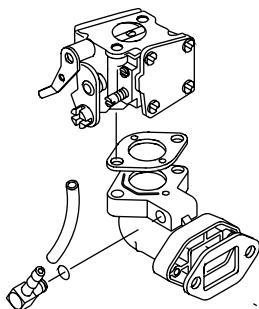


wc_gr002898

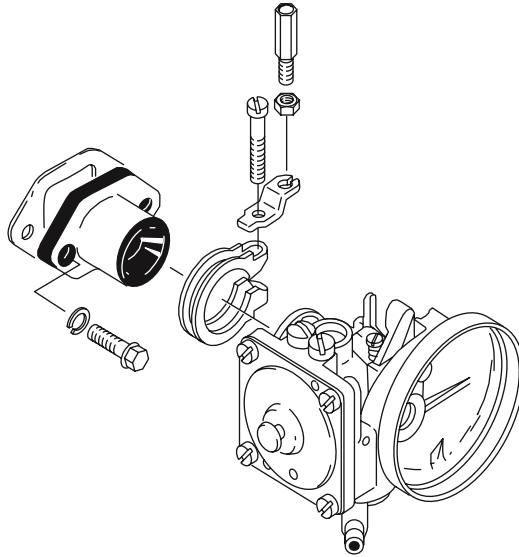
6.5 Tillotson with Elbow Adapters

See Graphic: *wc_gr002899*

- 6.5.1 Turn off the fuel valve at the tank and disconnect the spark plug lead wire.
- 6.5.2 Loosen the air filter pipe clamp and remove the carburetor adapter nuts. Remove the assembly from the engine.
- 6.5.3 Disconnect the throttle cable.
- 6.5.4 Remove the air duct from the carburetor and the carburetor from the adapter.
- 6.5.5 Protect the cylinder from dirt by cranking the engine until the piston is covering the intake port.



wc_gr002899



wc_gr002900

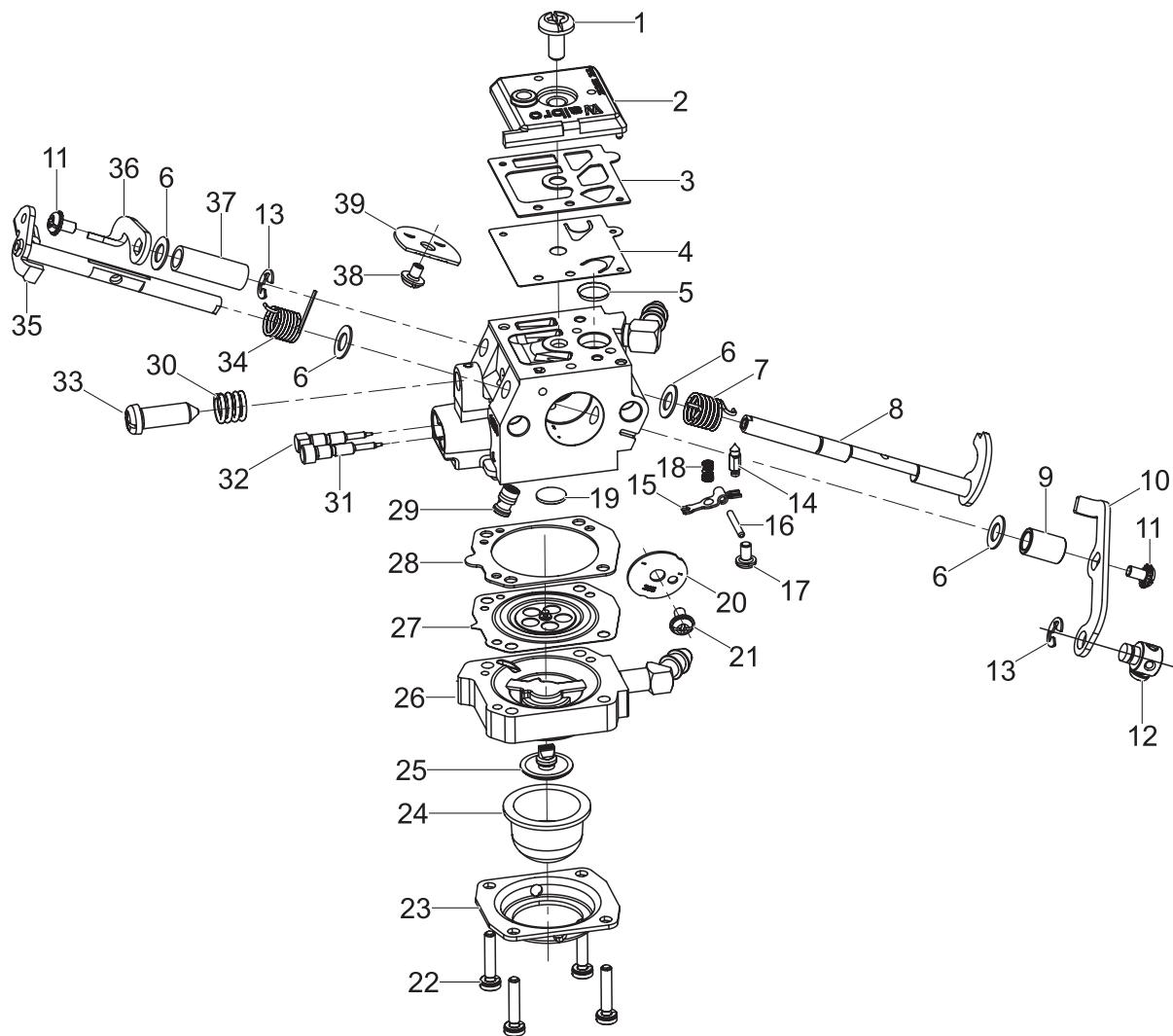
6.6 Bing

See Graphic: *wc_gr002900*

- 6.6.1 Turn off the fuel valve at the tank and disconnect the spark plug lead wire.
- 6.6.2 Remove the air filter pipe (loosen both clamps).
- 6.6.3 Disconnect the throttle cable.
- 6.6.4 Loosen the clamp which secures the carburetor to the adapter and slide the carburetor off the adapter.
- 6.6.5 Protect the cylinder from dirt by cranking the engine until the piston is covering the intake port.

7 Carburetor Overhaul

7.1 Walbro Carburetor Exploded View (auto-release choke models)



wc_gr007435

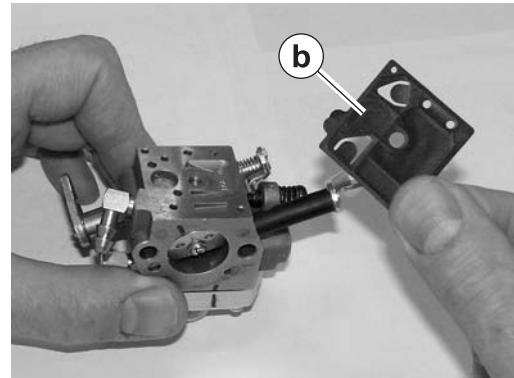
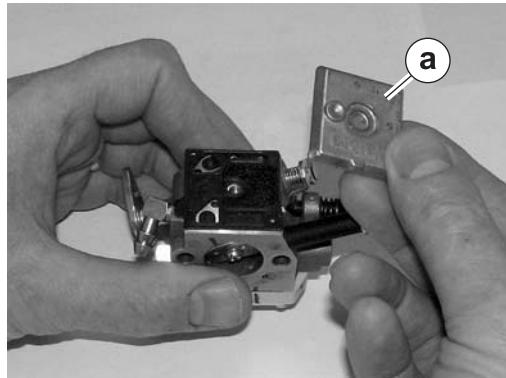
7.2 Walbro Carburetor Components (auto-release choke models)

Ref	Description	Ref	Description
1	Screw	21	Screw
2	Cover	22	Screw
3	Gasket	23	Cover
4	Diaphragm	24	Bulb
5	Screen	25	Valve
6	Washer	26	Air purge body assembly
7	Spring	27	Diaphragm
8	Choke shaft	28	Gasket
9	Spacer	29	Nozzle
10	Throttle lever	30	Spring
11	Screw	31	Needle
12	Swivel	32	Needle valve
13	Retaining ring	33	Idle speed screw
14	Inlet valve	34	Spring
15	Lever	35	Throttle shaft
16	Pin	36	Choke lever
17	Screw	37	Sleeve
18	Spring	38	Screw
19	Plug	39	Choke valve
20	Throttle valve	—	—

7.3 Rebuilding the Walbro Carburetor (auto-release choke models)

Disassembly

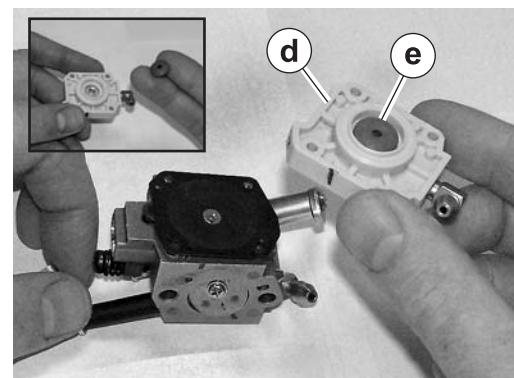
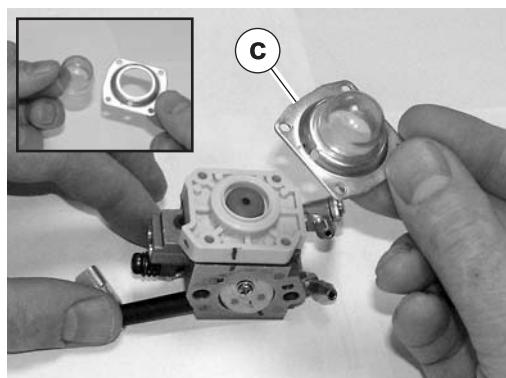
7.3.1 Remove the cover (a) from the fuel-pump side of the carburetor.



wc_gr005120

7.3.2 Remove the fuel pump diaphragm and gasket (b).

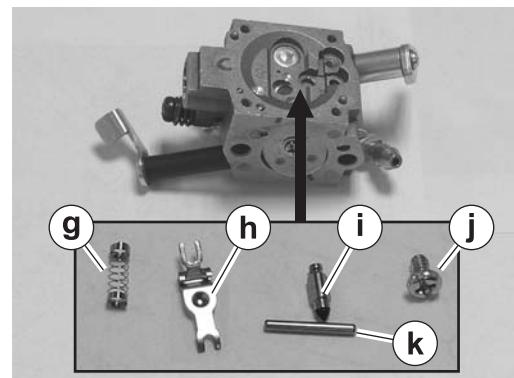
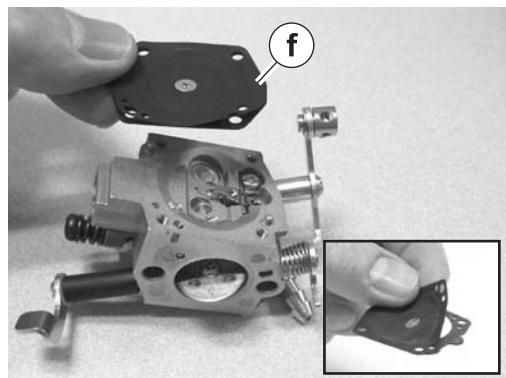
7.3.3 Remove the bracket and the air purge bulb (c). Separate the bulb from the bracket.



wc_gr005121

7.3.4 Remove the air purge body assembly (d). Remove the combination valve (e).

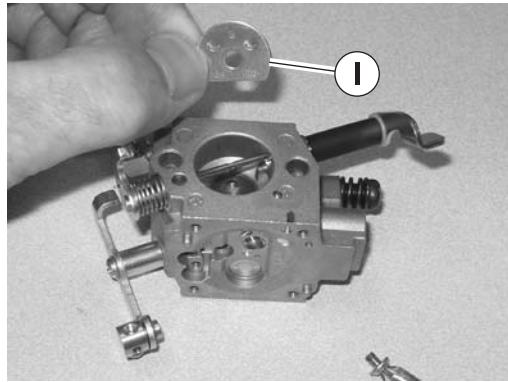
7.3.5 Remove the metering diaphragm (f).



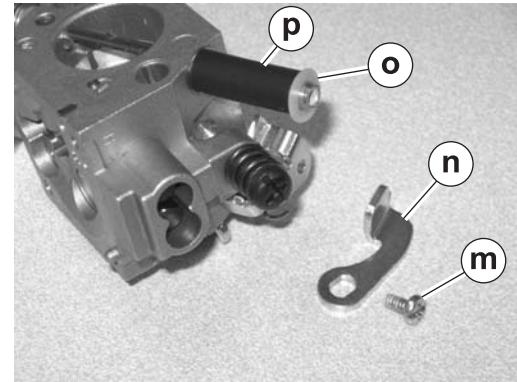
wc_gr007436

7.3.6 Remove the screw (j), metering lever (h), pin (k), spring (g), and inlet needle (i).

7.3.7 Remove the shutter (I) (butterfly).



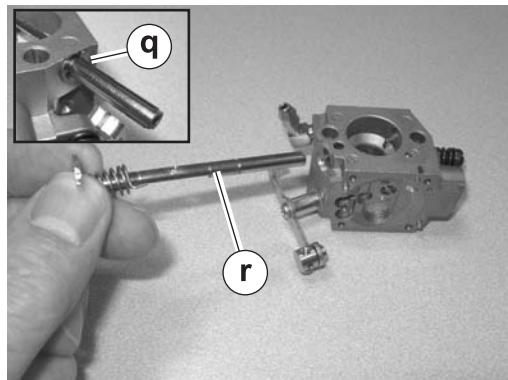
wc_gr007437



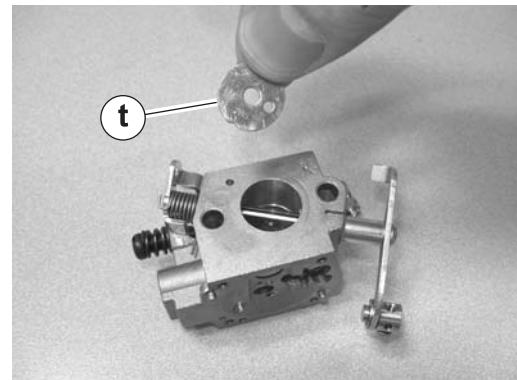
wc_gr007438

7.3.8 Remove the screw (m), lever (n), washer (o), and spacer (p).

7.3.9 Remove the retaining ring (q), then remove the choke shaft (r).



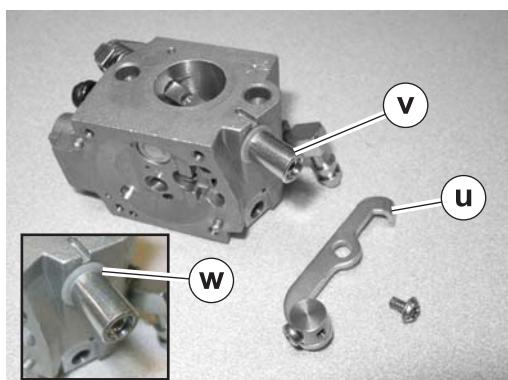
wc_gr007439



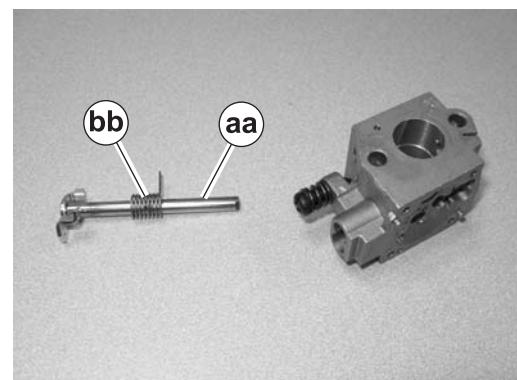
wc_gr007440

7.3.10 Remove the shutter (t) (butterfly) from the throttle shaft.

7.3.11 Remove the throttle lever (u), spacer (v), and washer (w).



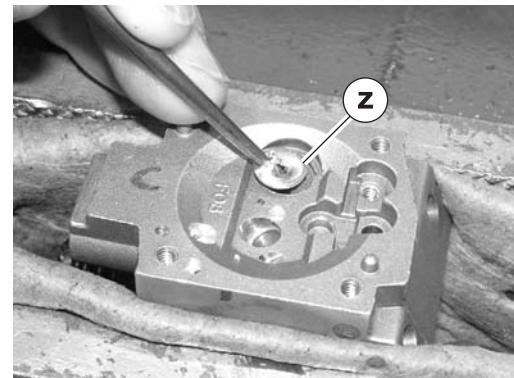
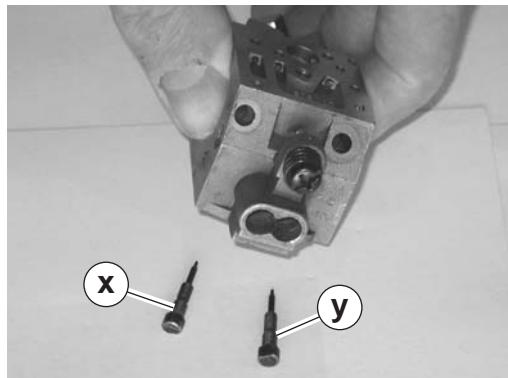
wc_gr007441



wc_gr007442

7.3.12 Remove the throttle shaft (aa) and the spring (bb).

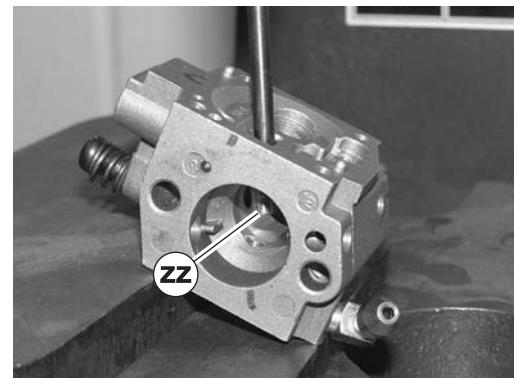
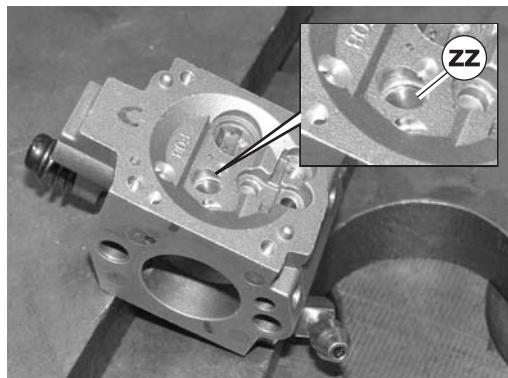
7.3.13 Non-EPA regulated countries only. Remove the high- and low-speed needle valves (**x** and **y**).



wc_gr005125

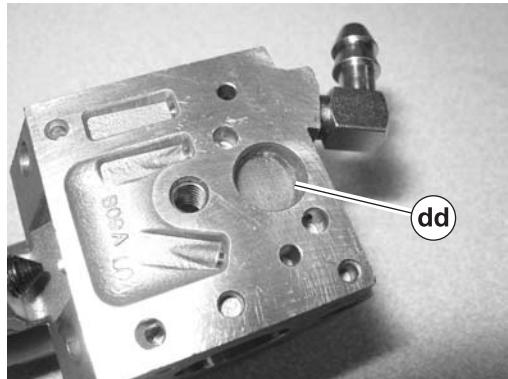
7.3.14 Using a punch, remove the Welch plug (**z**).

7.3.15 Non-EPA regulated countries only. Press out the main nozzle (**zz**).



wc_gr005126

7.3.16 Remove the screen(s) (**dd**).



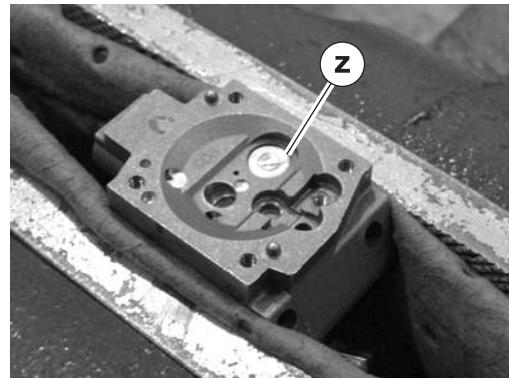
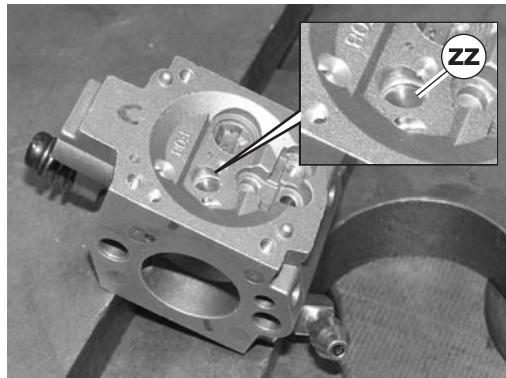
wc_gr007445

Result

The disassembly procedure is now complete.

Reassembly

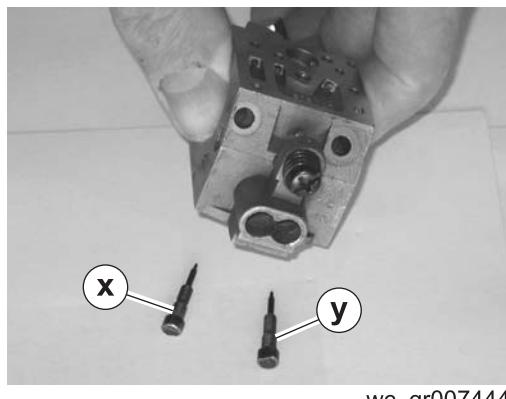
7.3.1 Align the hole in the main nozzle (zz) with the passage of the high-speed needle. Press the main nozzle into the carburetor body until the top of the main nozzle is flush with the carburetor body.



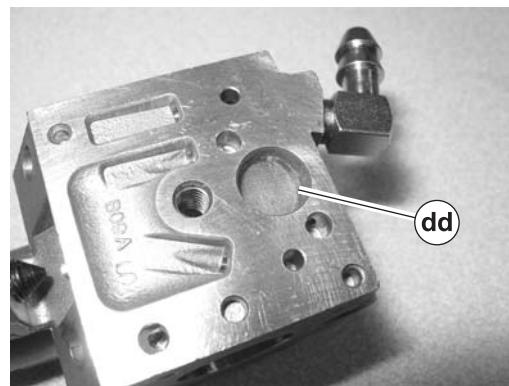
wc_gr005127

7.3.2 Install the Welch plug (z). Tap it in with a flat punch.

7.3.3 Install the high- and low-speed needles (x and y). **Note:** *The high-speed needle is shorter than the low-speed needle.*



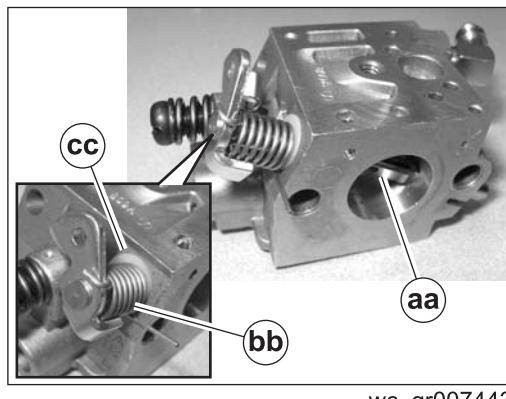
wc_gr007444



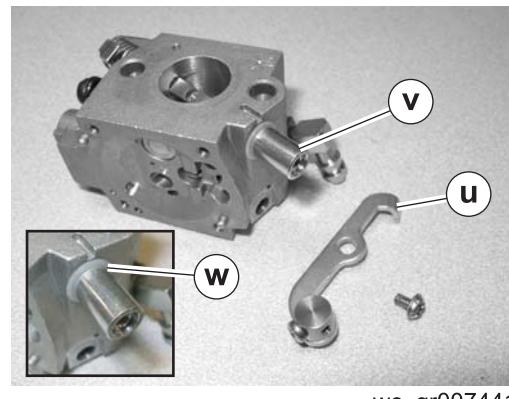
wc_gr007445

7.3.4 Install the screen(s) (dd).

7.3.5 Install the spring (bb) to the throttle shaft (aa). Install the washer (cc), then slide the throttle shaft into the carburetor body.



wc_gr007443



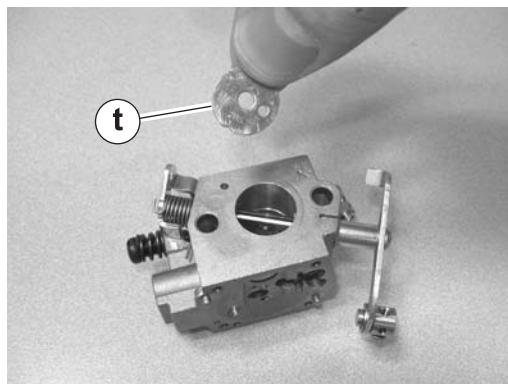
wc_gr007441

7.3.6 Install the washer (w), spacer (v), and the throttle lever (u).

This procedure continues on the next page.

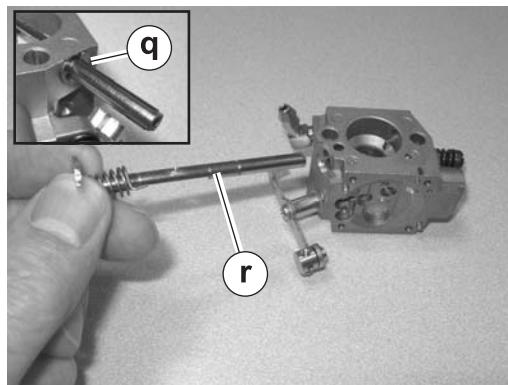
Continued from the previous page.

7.3.7 Install the shutter (t) (butterfly).

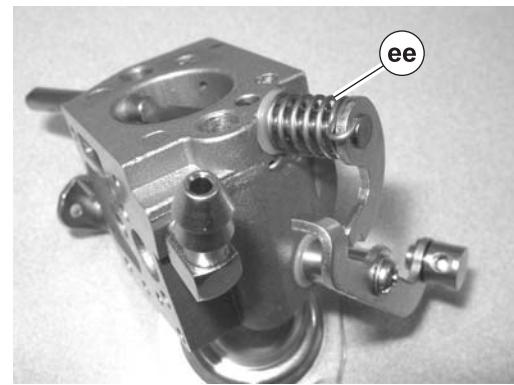


wc_gr007440

7.3.8 Install the spring and washer on the choke shaft, then install the choke shaft (r) into the carburetor body.



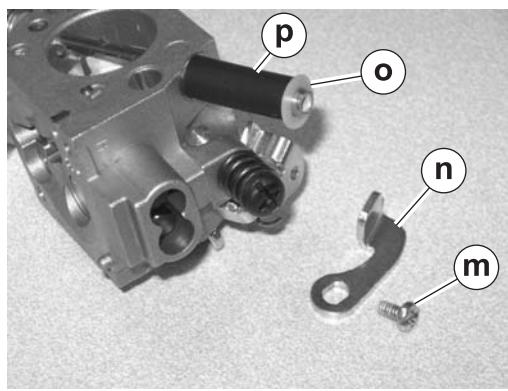
wc_gr007439



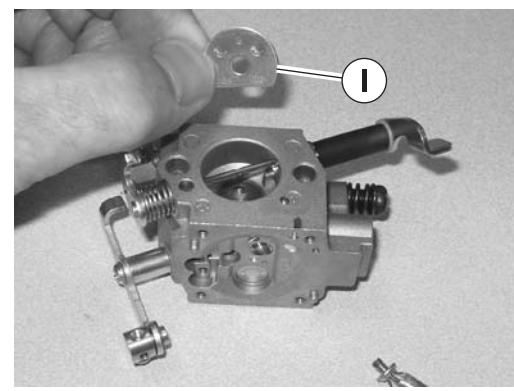
wc_gr007446

7.3.9 Align the spring (ee) as shown, then secure the choke shaft with retaining ring (q).

7.3.10 Install the spacer (p), washer (o), lever (n), with screw (m).



wc_gr007438



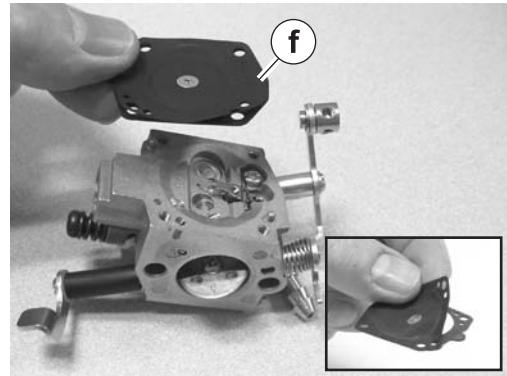
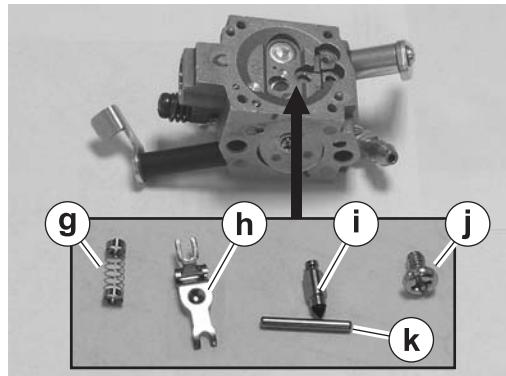
wc_gr007437

7.3.11 Install the shutter (I) (butterfly).

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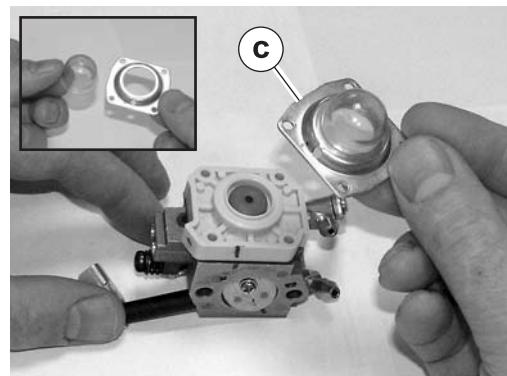
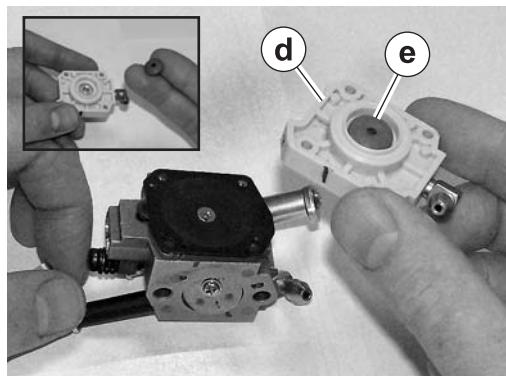
7.3.12 Install the screw (j), metering lever (h), pin (k), spring (g), and inlet needle (i).



wc_gr007447

7.3.13 Install the metering diaphragm (f).

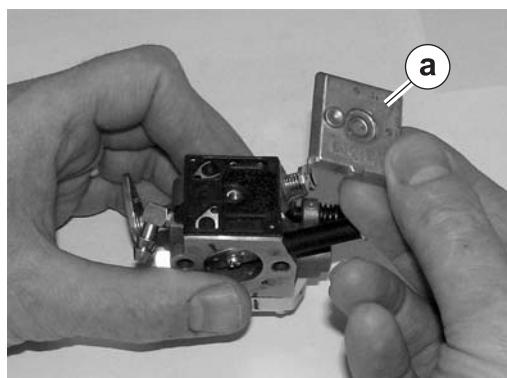
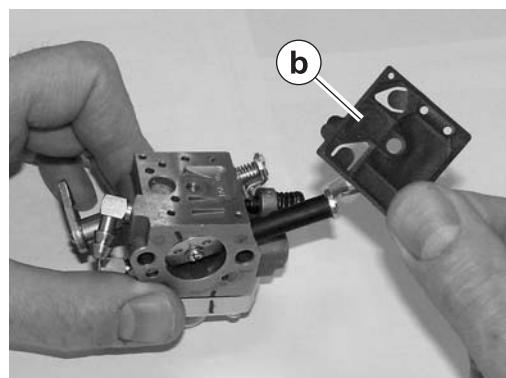
7.3.14 Install the combination valve (e) into the air purge body assembly (d), then install the air purge body assembly.



wc_gr007448

7.3.15 Install the air purge bulb (c) and bracket.

7.3.16 Install the fuel pump diaphragm (b).



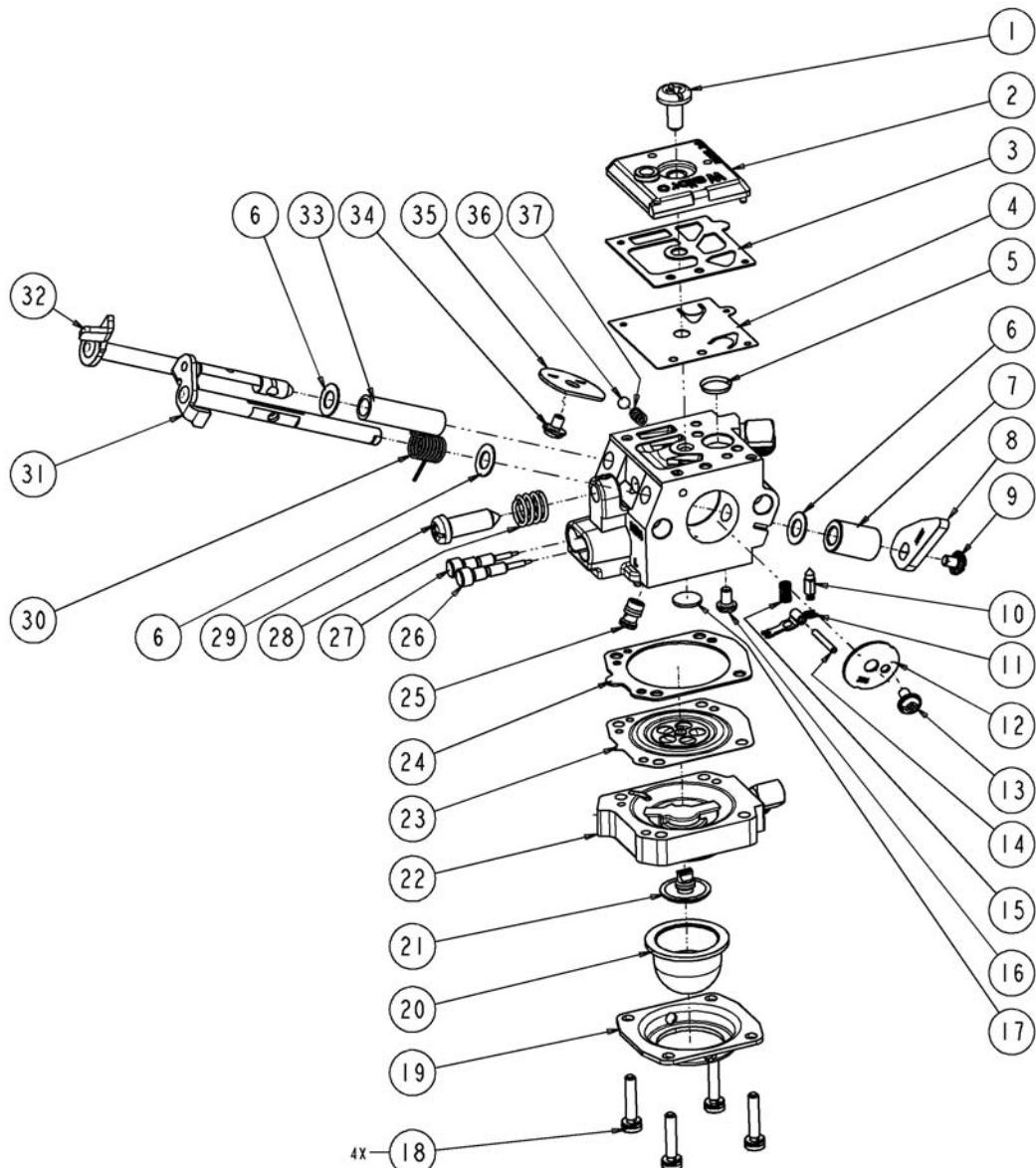
wc_gr007449

7.3.17 Install the cover (a).

Result

The reassembly procedure is now complete.

7.4 Walbro Carburetor Exploded View (standard choke models)



wc_gr005118

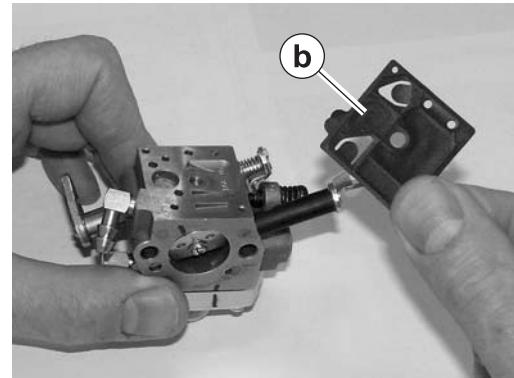
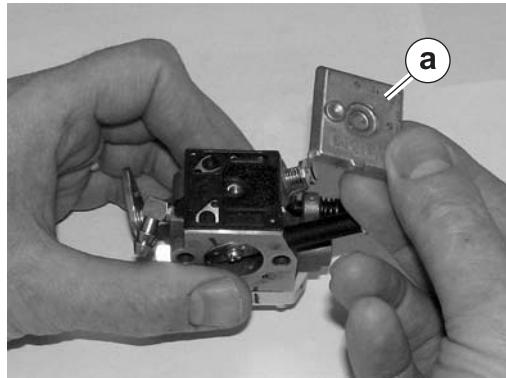
7.5 Walbro Carburetor Components (standard choke models)

Ref	Description	Ref	Description
1	Screw	20	Bulb
2	Cover	21	Combination valve
3	Gasket	22	Air purge body assembly
4	Diaphragm	23	Diaphragm
5	Screen	24	Gasket
6	Washer	25	Nozzle
7	Spacer	26	Idle needle
8	Lever	27	Power needle
9	Screw	28	Spring
10	Inlet needle	29	Screw
11	Metering lever	30	Spring
12	Throttle shutter	31	Throttle shaft
13	Screw	32	Choke shaft
14	Pin	33	Spacer
15	Spring	34	Screw
16	Screw	35	Choke shutter
17	Welch plug	36	Ball
18	Screw	37	Spring
19	Cover	---	---

7.6 Rebuilding the Walbro Carburetor (standard choke models)

Disassembly

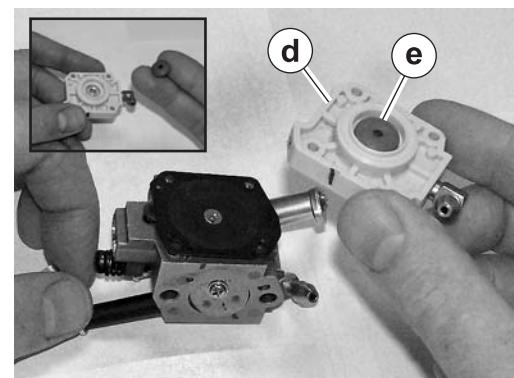
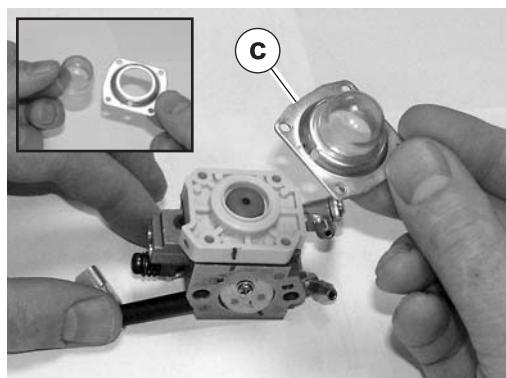
7.6.1 Remove the cover (a) from the fuel-pump side.



wc_gr005120

7.6.2 Remove the fuel pump diaphragm and gasket (b).

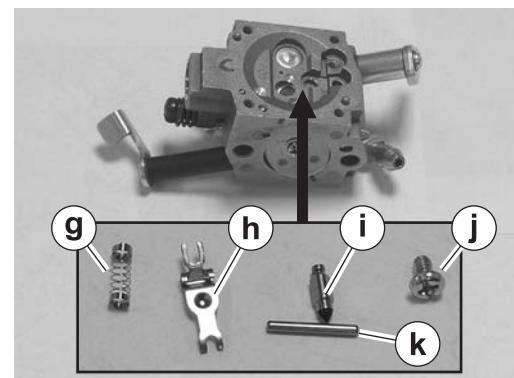
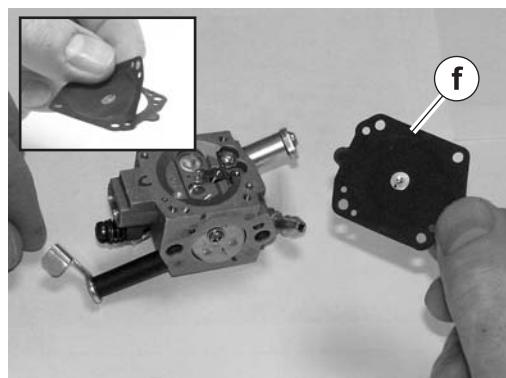
7.6.3 Remove the bracket and the air purge bulb (c). Separate the bulb from the bracket.



wc_gr005121

7.6.4 Remove the air purge body assembly (d). Remove the combination valve (e).

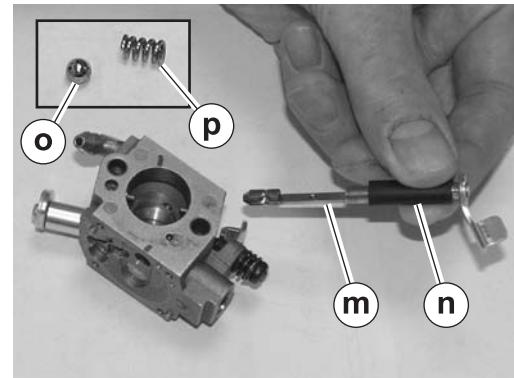
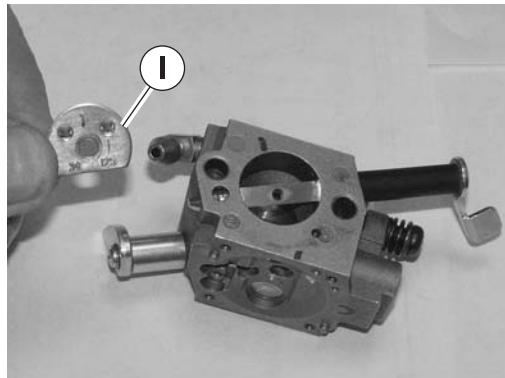
7.6.5 Remove the metering diaphragm (f).



wc_gr005122

7.6.6 Remove the screw (j), metering lever (h), pin (k), spring (g), and inlet needle (i).

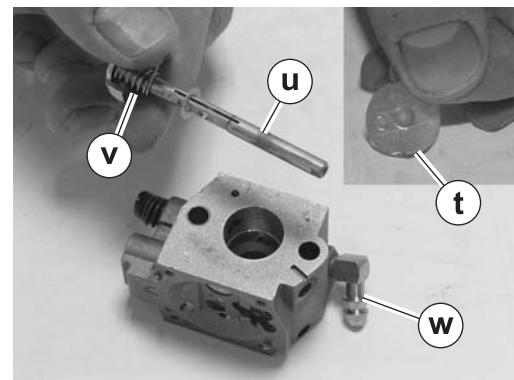
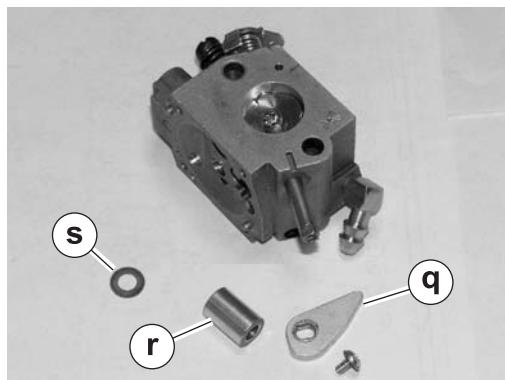
7.6.7 Remove the shutter (I) (butterfly).



wc_gr005123

7.6.8 Remove the choke shaft (m) and spacer (n). Also remove the ball (o) and the spring (p) from the carburetor body.

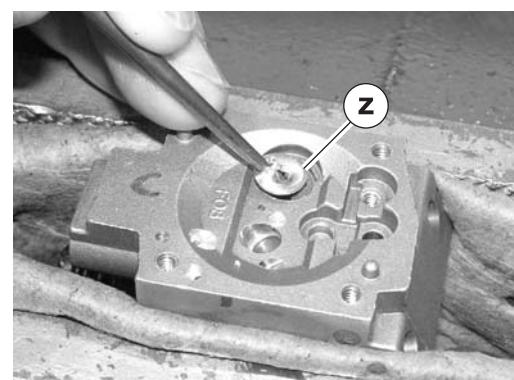
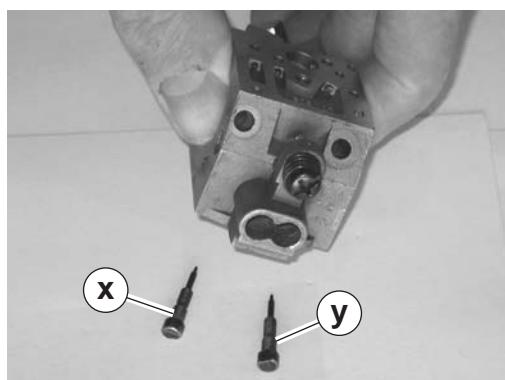
7.6.9 Remove the throttle lever (q), spacer (r), and washer (s).



wc_gr005124

7.6.10 Remove the shutter (t) (butterfly), then pull the throttle shaft (u) from the carburetor body. Remove the spring (v) and nipple (w).

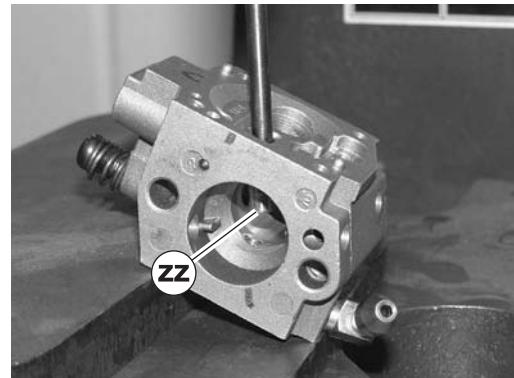
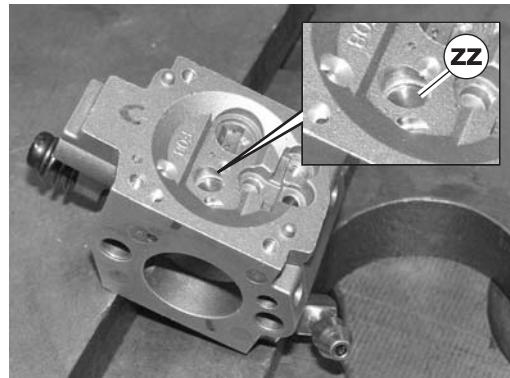
7.6.11 Non-EPA regulated countries only. Remove the high- and low-speed needle valves (x and y).



wc_gr005125

7.6.12 Using a punch, remove the Welch plug (z).

7.6.13 Non-EPA regulated countries only. Press out the main nozzle (zz).

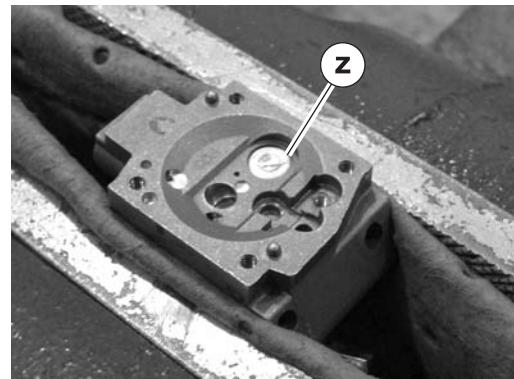
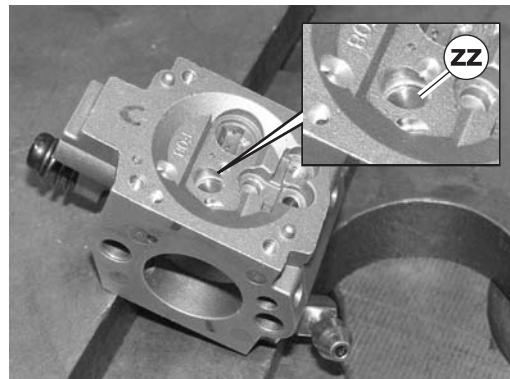


wc_gr005126

The procedure is now complete.

Reassembly

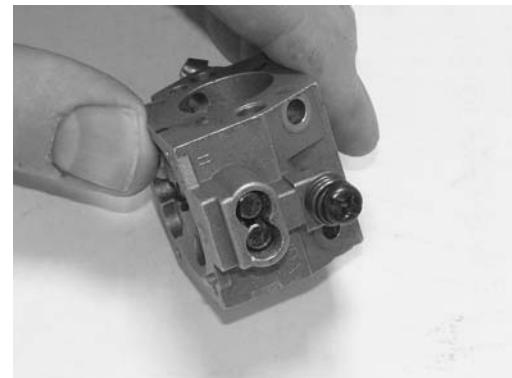
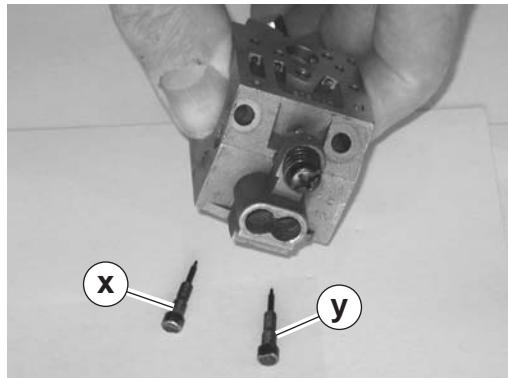
7.6.1 Align the hole in the main nozzle (zz) with the passage of the high-speed needle. Press the main nozzle into the carburetor body until the top of the main nozzle is flush with the carburetor body.



wc_gr005127

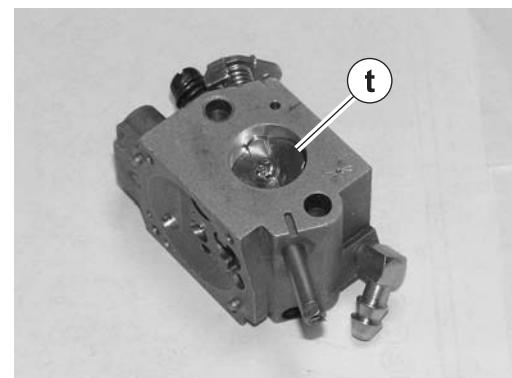
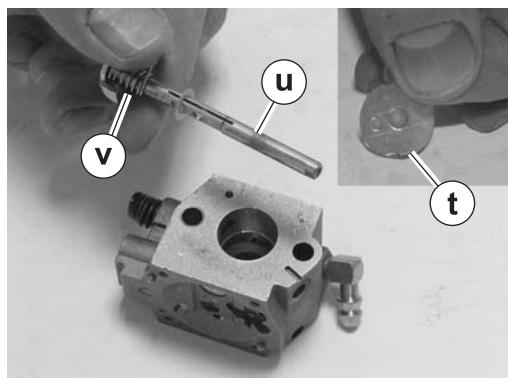
7.6.2 Install the Welsh plug (z). Tap it in with a flat punch.

7.6.3 Install the high- and low-speed needles (x and y). **Note:** *The high-speed needle is shorter than the low-speed needle.*



wc_gr005128

7.6.4 Install the spring (v) to the throttle shaft (u). Install the throttle shaft into the carburetor body and install the shutter (t) (butterfly).

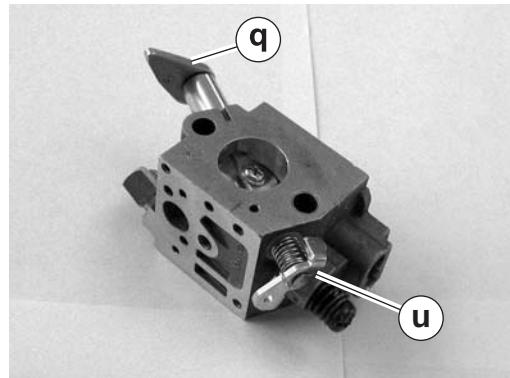
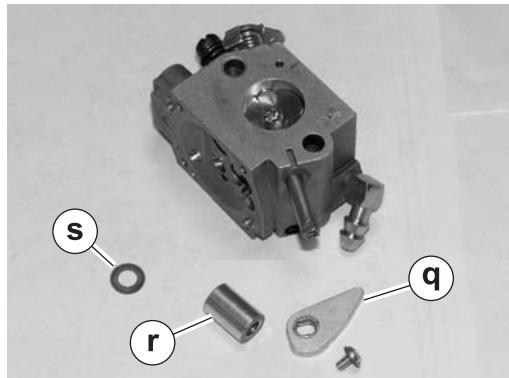


wc_gr005129

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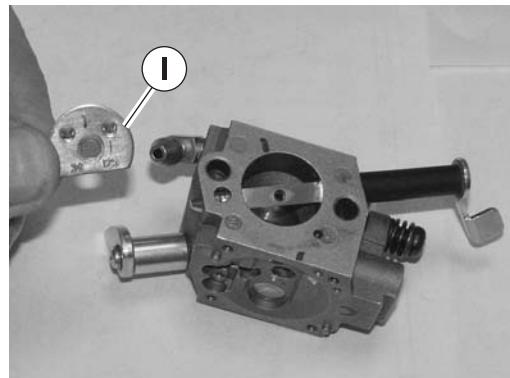
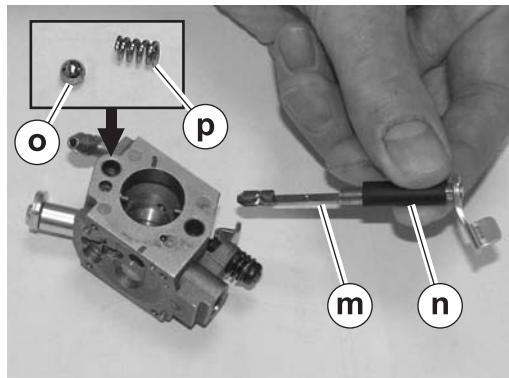
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7.6.5 Install the washer (s), spacer (r), and the throttle lever (q). Note the positioning of the throttle lever (q) compared to the throttle shaft (u).



wc_gr005130

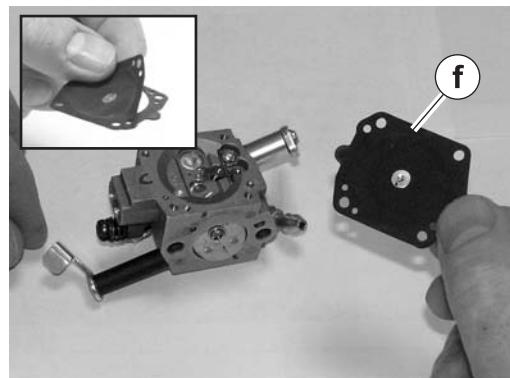
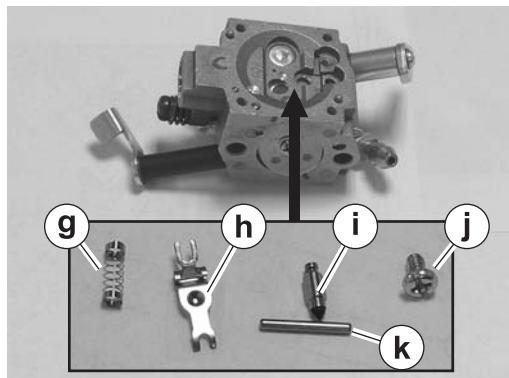
7.6.6 Install the spring (p) and ball (o). Install the spacer (n) and choke shaft (m).



wc_gr005131

7.6.7 Install the shutter (l) (butterfly).

7.6.8 Install the inlet needle (i), spring (g), pin (k), and metering lever (h) with the screw (j).



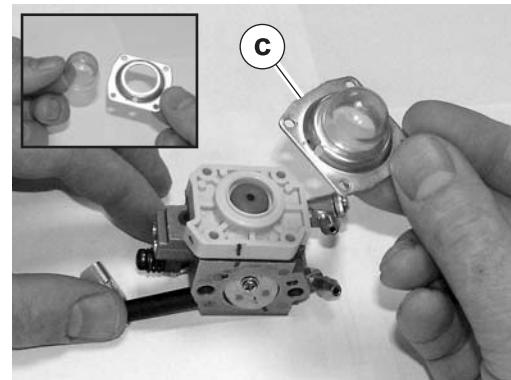
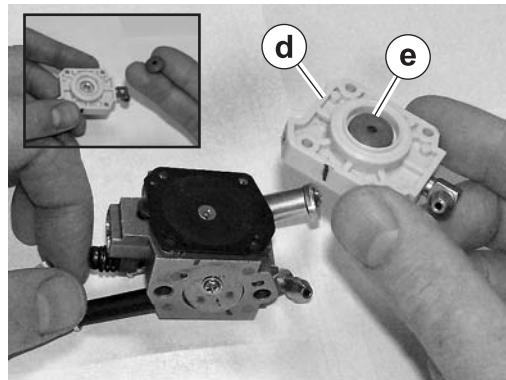
wc_gr005132

7.6.9 Install the new diaphragm (f) and the new gasket. Be sure the diaphragm hooks into the metering lever.

This procedure continues on the next page.

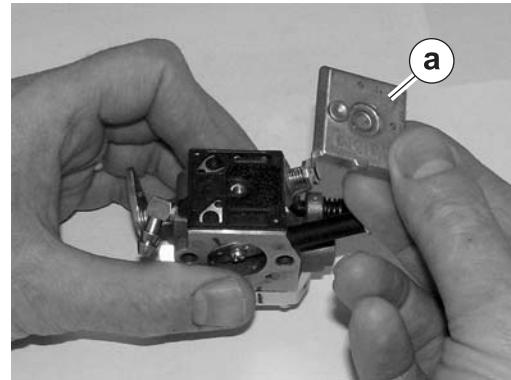
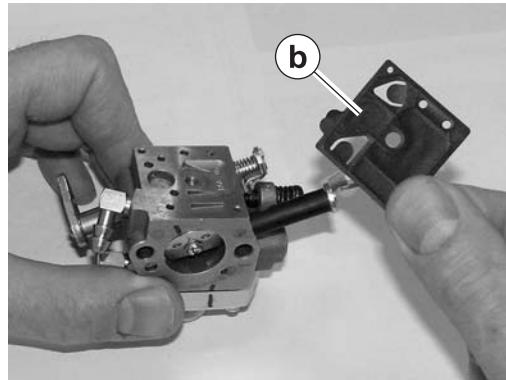
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7.6.10 Install the combination valve (e). Install the air purge body assembly (d), bracket, and air purge bulb (c).



wc_gr005133

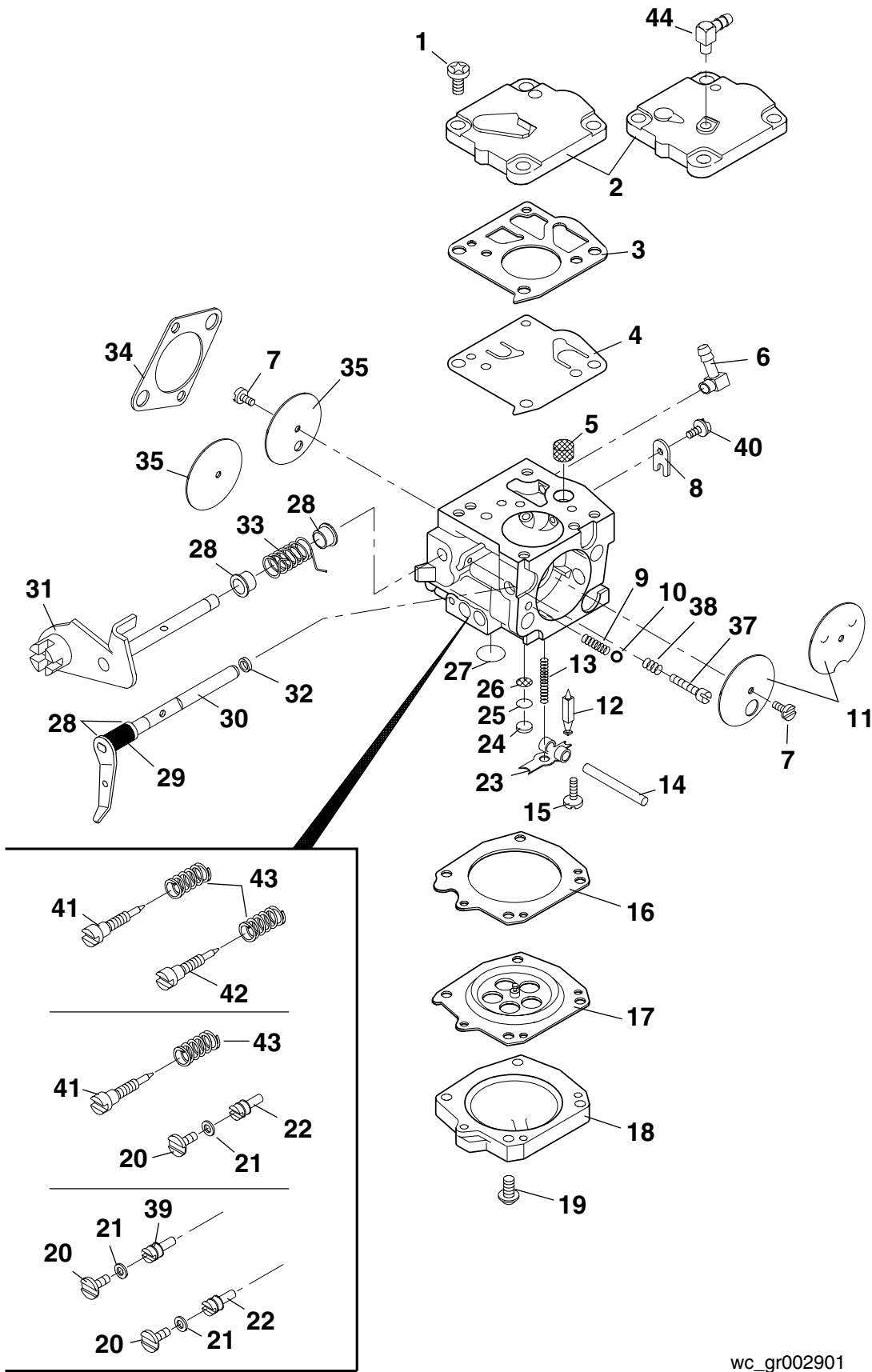
7.6.11 Install the new fuel pump diaphragm then the new gasket (b). Be sure to align each with the positioning pins.



wc_gr005134

7.6.12 Install the cover (a).

7.7 Tillotson Carburetor Exploded View



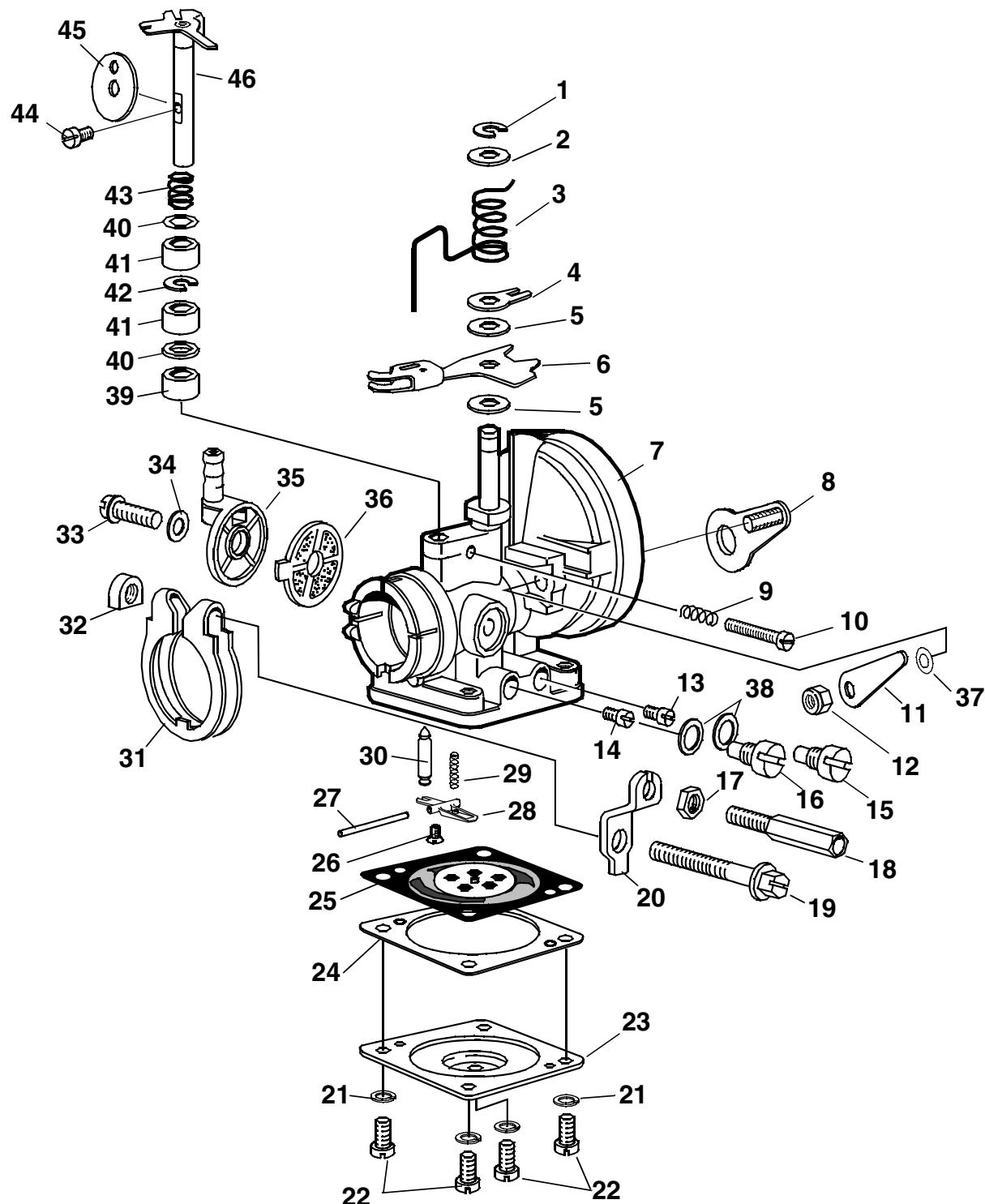
wc_gr002901

7.8 Tillotson Components

See Graphic: wc_gr002901

Ref	Description	Ref	Description
1	Screw	23	Control lever
2	Cover	24	Plug
3	Gasket	25	Retaining ring
4	Diaphragm	26	Screen
5	Screen	27	Plug
6	Elbow fitting	28	Bushing
7	Screw w/ lock washer	29	Bushing
8	Clip	30	Choke shaft
9	Spring	31	Throttle shaft
10	Ball	32	O-Ring
11	Choke shutter	33	Spring
12	Needle-fuel inlet	34	Gasket
13	Spring	35	Throttle shutter
14	Pin	37	Screw
15	Screw	38	Spring
16	Gasket	39	Low-speed jet
17	Diaphragm	40	Screw
18	Cover	41	Low-speed screw
19	Screw w/ lock washer	42	High-speed screw
20	Screw	43	Spring
21	Washer	44	Fitting (impulse line)
22	Main jet		

7.9 Bing Carburetor Exploded View



wc_gr002902

7.10 Bing Carburetor Components

See Graphic: wc_gr002902

Ref	Description	Ref	Description
1	Retaining ring	24	Gasket
2	Washer	25	Diaphragm
3	Spring	26	Screw
4	Brake control	27	Pin
5	Washer	28	Control lever
6	Throttle control lever	29	Spring
7	Carburetor body	30	Needle
8	Choke	31	Clamp
9	Spring	32	Nut
10	Idle stop screw	33	Screw
11	Choke lever	34	Sealing ring
12	Nut	35	Cover
13	Main jet #62	36	Fuel filter screen
14	Idle jet #35	37	Washer
15	Plug	38	Gasket
16	Plug	39	Spacer
17	Nut	40	Washer
18	Adjustment screw	41	Spacer
19	Clamp screw	42	Retaining ring
20	Bracket	43	Spring
21	Lockwasher	44	Screw
22	Screw	45	Throttle shutter
23	Cover	46	Throttle shaft

8 Carburetor Inspection and Adjustment

8.1 Inspection

Diaphragms:

- Check for tears, punctures, and distortion in the elastic material. Replace the diaphragm if it appears stretched or puckered.
- Be certain diaphragms are installed correctly. See appropriate exploded view. On Walbro and Tillotson carburetors, be sure that the control diaphragm is connected to the inlet lever.
- Evenly tighten all screws securing the diaphragm covers to ensure good seal and avoid leaks.
- Complete repair kits are available: P/N 0171010—Walbro carburetors; P/N 2005690—Tillotson carburetors; P/N 0065689—Bing carburetors.

Inlet Needle Valve:

- The inlet needle must seal properly or the engine may flood or run rich. The elastic tip must be in good condition. Replace the needle if the tip becomes hard or brittle.
- Keep the seating area clean and free from dirt. Clean it using compressed air.

Control Lever Spring:

- Be certain that the spring is seated correctly under the inlet lever and that it has enough tension to seat the inlet needle. Replace the spring if worn or broken. Do not stretch the spring.

Adjustable Mixture Needle Valves (Tillotson):

- On Tillotson carburetors with adjustable mixture needle valves, the valves must have absolutely smooth points. Replace the needle valves if the taper appears worn or damaged.

NOTICE: Do not turn in the adjusting screws too tight or the valve seats may be damaged.

Fixed Jets:

- Clean the jet orifice using compressed air. Use a narrow screwdriver when installing jets to avoid shaving metal from inside of the carburetor body which could plug the jet orifice.

8.2 Adjusting the Inlet Control Lever

See Graphic: *wc_gr002903*

Walbro:

Use the special tool **(e)** to set height of metering lever.

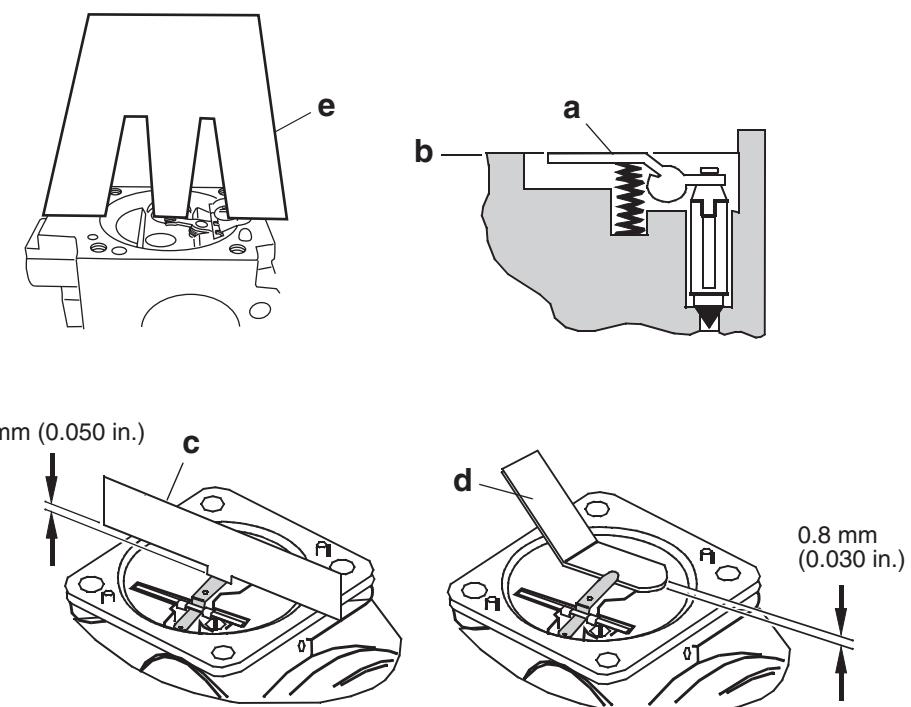
Tillotson:

Set the inlet control lever **(a)** so that it is flush with the floor of the fuel chamber **(b)**. Bend the end of the control lever up or down as required.

Bing:

Set the inlet control lever so that it is 1.4 mm (0.055 in.) below the surface of the carburetor casting by bending the tab up or down as required. Check the distance with the carburetor gauge **(c)**. If no gauge is available, set the distance to be 0.8 mm (0.030 in.) between the tip of the lever and the bottom of the fuel chamber with a feeler gauge **(d)**.

On Bing carburetors using molded plastic lever, no inlet lever adjustment is required.



wc_gr002903

8.3 Carburetor Adjustments

Walbro:

Procedures apply in only non-EPA regulated applications.

Both high- and low-speed mixture adjustment is possible. A special tool is required. See section *Operating & Idle Speeds* for correct operating and idle speed settings. For best accuracy use a tachometer when making carburetor adjustments.

For initial carburetor set-up after rebuilding, complete the following procedures:

- 8.3.1 Turn in (clockwise) high- (**H**) and low-speed mixture needle valve (**L**) by hand until tight.
NOTICE: Do not overtighten the valves. Damage to the valve seats may result.
Preset the fuel jets as follows:
 - 8.3.2 Open the low-speed needle valve 1-1/2 revolutions counterclockwise.
 - 8.3.3 Open the high-speed needle valve 3-1/2 revolutions counterclockwise.
 - 8.3.4 Start the engine and allow it to run at high speed for 3–6 minutes. Check the adjustments by running the machine at full throttle and at idle several times. Keep the choke fully open. If further adjustments are necessary, continue with step 5.
Note: *After full throttle operation, allow engine to idle one minute before making any adjustments.*
 - 8.3.5 When making carburetor adjustments, turn the valve screws in small increments, no more than 1/16 of a revolution (turn) at a time. Turn the screws clockwise to lean, counterclockwise to enrich. Allow 5 seconds after each adjustment for engine to stabilize.

See Graphic: wc_gr002904

Tillotson Dual Needle:

Both high- and low-speed mixture adjustment is required on dual needle models. See section *Operating & Idle Speeds* for correct operating and idle speed settings. For best accuracy use a tachometer when making carburetor adjustments.

For initial carburetor set-up after rebuilding, complete the following procedures:

- 8.3.6 Turn in (clockwise) high- **(H)** and low-speed mixture needle valve **(L)** by hand until tight.

NOTICE: Do not overtighten the valves. Damage to the valve seats may result.

Preset the fuel jets as follows:

- 8.3.7 Open the low-speed needle valve 3/4 revolution counterclockwise.

- 8.3.8 Open the high-speed needle valve 1-1/4 revolutions counterclockwise.

- 8.3.9 Start the engine and allow it to run at high speed for 3–6 minutes. Check the adjustments by running the machine at full throttle and at idle several times. Keep the choke fully open. If further adjustments are necessary, continue with step 5.

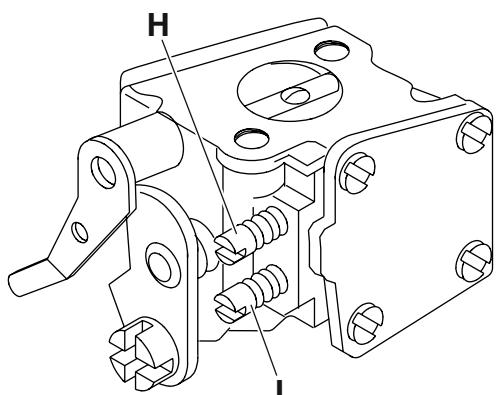
Note: After full throttle operation, allow engine to idle one minute before making any adjustments.

- 8.3.10 When making carburetor adjustments, turn the valve screws in small increments, no more than 1/16 of a revolution (turn) at a time. Turn the screws clockwise to lean, counterclockwise to enrich. Allow 5 seconds after each adjustment for engine to stabilize.

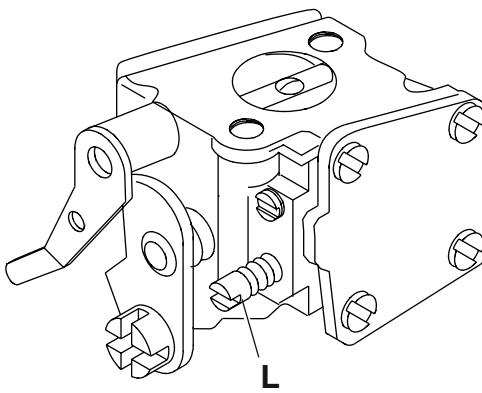
- 8.3.11 Check the low-speed adjustment first by accelerating the machine to high speed. If the engine bogs down during acceleration and/or dies, the carburetor is set too lean. If the engine bogs down then accelerates slowly, the carburetor is set too rich. Adjust low speed until good acceleration is achieved. Re-adjust idle speed screw for required idle speed.

- 8.3.12 Adjust the high speed screw to obtain the best operating speed. Running too lean or too rich will cause the engine to run at a lower rpm than optimal. If the high-speed needle valve is set too rich, the engine will emit black smoke from the muffler.

NOTICE: Because the engine is lubricated by the fuel mixture, do not lean-out the carburetor too much; the engine may overheat and damage components.



wc_gr002904



wc_gr002905

See Graphic: *wc_gr002905*

Tillotson Single Needle:

On single-needle Tillotson carburetors the high-speed fuel jet is fixed; only the low-speed jet can be adjusted. See section *Operating & Idle Speeds* for correct operating and idle speed settings. For initial carburetor set-up after rebuilding, complete the following procedures:

- 8.3.13 Turn in (clockwise) the low-speed mixture valve (**L**) by hand until tight.
NOTICE: Do not overtighten valve. Damage to valve seats may result.
- 8.3.14 Preset the low-speed mixture valve by opening it 1 revolution (turn) counterclockwise.
- 8.3.15 Start the engine and allow it to warm up to operating temperature by running it at high speed for 3–6 minutes.
- 8.3.16 Set the engine idle speed with the engine throttle control closed and the choke fully open. Adjust the low-speed mixture valve until the correct low speed is set. Turn the valve clockwise to lean, counterclockwise to enrich.

Tillotson Idle By-pass and Bing Carburetors:

These carburetors use fixed jets for high- and low-speed operation, and no adjustments are required. Correct idle speed is obtained by adjusting the idle speed screw. Adjust idle speed with the throttle control closed, the choke open, and the machine warm. See section *Operating & Idle Speeds* for correct operating and idle speed settings.

9 Carburetor Troubleshooting

9.1 Troubleshooting Walbro Carburetors

Problem	Probable Cause	Remedy
Engine floods.	Worn inlet needle body or tip.	Replace the inlet needle.
	Inlet needle sticking	Check spring tension and metering lever.
	Dirt or gum formations preventing the inlet needle from sealing	Remove and clean the carburetor.
	Metering lever set incorrectly.	Adjust metering lever.
	Diaphragm installed incorrectly	Correct diaphragm installation.
Engine will not accelerate.	Metering lever set too low.	Adjust metering lever.
	Metering lever binding.	Clean metering lever.
	Loose mounting bolts.	Tighten mounting bolts.
	Main nozzle plugged	Replace the main nozzle.
	Fuel hose plugged	Replace the fuel hose.
Engine will not idle.	Idle speed incorrectly adjusted	Reset the idle speed.
	Throttle not fully returning to idle	Adjust throttle cable and inspect the throttle shaft for sticking.
	Throttle plate cocked in the bore causing fast idle	Reposition throttle plate.
	Idle discharge ports plugged	Clean the carburetor or blow it out with compressed air.
	Defective manifold gaskets.	Replace gaskets.
	Inlet needle not seating	Clean and/or replace the inlet needle.
Engine runs rich.	Defective pump diaphragm.	Replace pump diaphragm.
	Metering lever set too high.	Adjust metering lever.
	Metering lever stuck.	Clean carburetor.
	Worn inlet needle body or tip.	Replace the inlet needle.

9.2 Troubleshooting Tillotson and Bing Carburetors

Problem	Probable Cause	Remedy
Engine floods.	Defective or missing fuel filter allowing dirt to enter carburetor	Install a new fuel filter.
	Inlet needle sticking	Check spring tension and axle point.
	Dirt or gum formations preventing the inlet needle from sealing	Remove and clean the carburetor.
	Inlet control lever set	Adjust inlet control lever.
	Control lever spring not seated on lever	Remove and either replace or reinstall the control lever.
Engine will not accelerate.	Idle mixture is too lean.	Adjust idle mixture.
	Diaphragm cover plate loose; air leak	Check and tighten the cover plate.
	Inlet control lever is set incorrectly.	Correct the lever adjustment.
	Main fuel discharge nozzle plugged	Clean the carburetor or blow it out with compressed air.
	Control diaphragm punctured	Replace the diaphragm.
Engine will not idle.	Idle speed incorrectly adjusted	Reset the idle speed.
	Throttle not fully returning to idle	Adjust throttle cable and inspect the throttle shaft for sticking.
	Throttle plate cocked in the bore causing fast idle	Reposition throttle plate.
	Idle discharge ports plugged	Clean the carburetor or blow it out with compressed air.
	Inlet control lever incorrectly set	Readjust the inlet control lever.
	Inlet needle not seating	Clean and/or replace the inlet needle.

Engine runs rich.	High-speed adjustment incorrect	Readjust the high speed.
	High-speed mixture needle valve damaged	Replace the high-speed mixture needle valve.
	The size of the fixed jet is incorrect.	Replace the fixed jet with correct size.
	Plug covering main discharge port is leaking.	Install new plug.

10 Disassembly and Assembly

10.1 Tools

Because all possible problems encountered while repairing the machine cannot be anticipated, it is up to the mechanic to use common sense and good judgement in tool selection.

The use of any special tools is recommended only for those operations where the use of conventional tools proves inadequate.

Before substituting another tool or procedure, you should be satisfied that neither personal injury nor damage to the component will result.

10.2 Special Tools

The following list of special tools will be needed when disassembling and assembling the machine.

Tool	Part Number	Tool	Part Number
Bearing extractor	0013288	Flywheel puller	0046503
Holding ring	0013290	Pusher tube (Seal and bearing installer)	0048585
Split shell puller	0017328	4-shoe clutch puller (BHF 30S, BS 45Y, BS 50Y, BS 52Y, BS 60Y)	0049776
Crankshaft support tube	0023339	2-shoe clutch puller	0117972
Ring compressor	0031986	Clutch puller (BS 62Y, BS 65Y)	0045064
Crankshaft support plate	0032028	Vacuum test kit	0155268
Split ring puller	0023338	Pressure tester gauge	0079264

10.3 Ordering Parts

The repair procedures contained in this manual do not include part numbers. For parts replacement information, refer to the Parts Book originally supplied with the machine.

If the original Parts Book has been lost, a replacement may be ordered from Wacker Neuson Corporation. When ordering a replacement Parts Book, please list the model number, item number, revision level, and serial number of the machine. Parts Books are also available on the Wacker Neuson Corporation Web site. See www.wackerneuson.com. Enter the site as a visitor.

10.4 Reference Numbers ()

Repair procedures contain reference numbers enclosed in parentheses (). These numbers refer to the item numbers shown on the assembly drawings and other detailed drawings. They are included to aid the mechanic in identifying parts and assembling components.

10.5 Threadlocking Compounds

Due to the heavy vibration inherent in this type of equipment, the repair and service procedures described in this manual specify the use of threadlocking compounds. These compounds should be used where indicated to prevent the fasteners from becoming loose.

Although Loctite® is referred to throughout this manual, any equivalent type of sealant such as Herno, Prolock, or Omnifit may be used. Clean the screw threads and wipe off any oil or grease before applying a threadlocking compound.

For a complete list of recommended sealing and locking compounds, refer to the *Use of Threadlockers and Sealants* chart at the end of this Repair Manual.

10.6 Removing the WM 80 Engine from BS Rammers (auto-release choke models)

Requirements

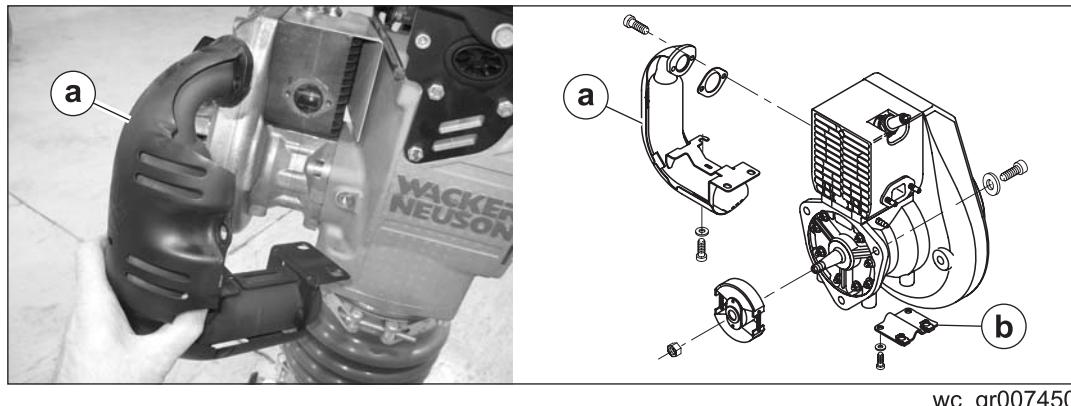
- Engine cool
- Carburetor removed

Removal

Perform the procedure below to remove the engine.

10.6.1 Remove the carburetor. See topic *Removing the Carburetor*.

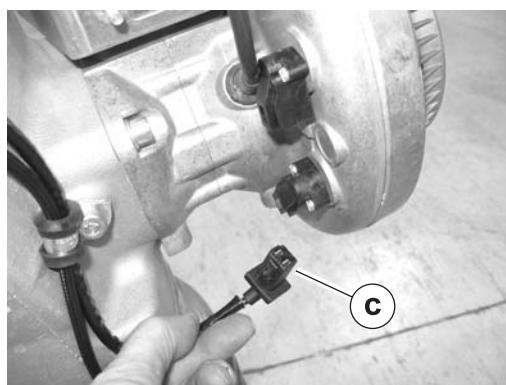
10.6.2 Remove the muffler (a).



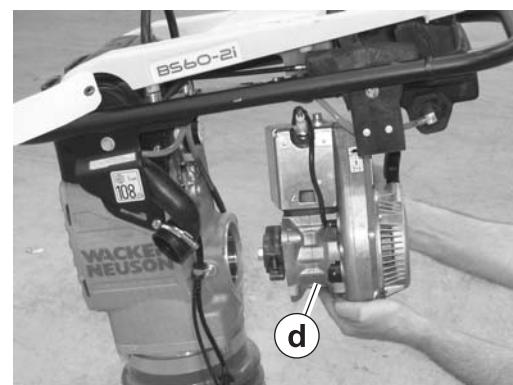
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10.6.3 Remove the bracket (b).

10.6.4 Disconnect the wiring to the switches (c).



wc_gr007451



wc_gr007452

10.6.5 Remove the screws that hold the engine and remove the engine (d) from the machine.

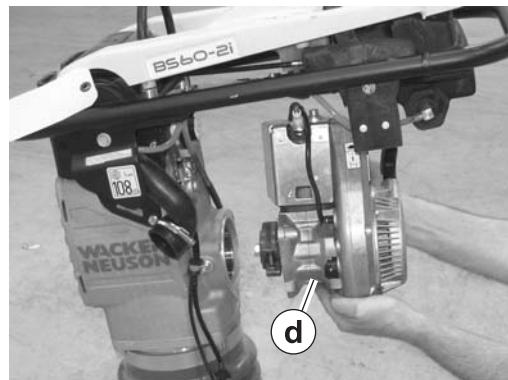
Result

The engine has now been removed.

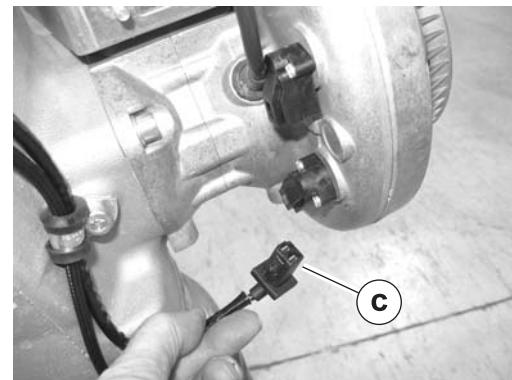
Installation

Perform the procedure below to install the engine.

10.6.6 Install the engine (**d**) to the machine with three screws. Torque the screws to 28 Nm (20 ft.lbs.).



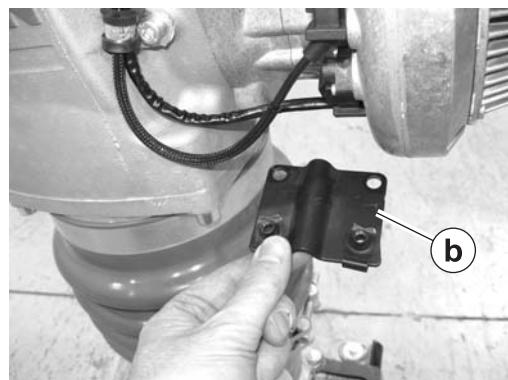
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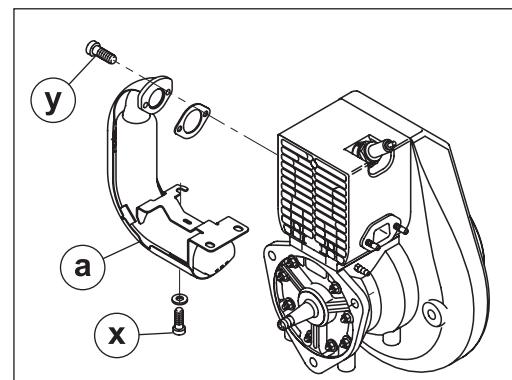
wc_gr007451

10.6.7 Reconnect the wiring (**c**) to the switches.

10.6.8 Install the bracket (**b**).



wc_gr007453



wc_gr007555

10.6.9 Install the muffler (**a**). Torque screws (**x**) to 18 Nm (13 ft.lbs.). Torque screw (**y**) to 23 Nm (16 ft.lbs.).

10.6.10 Install the carburetor.

Result

The engine has now been installed.

10.7 Removing Engine From BS Model Rammers (standard choke models)

See Graphic:wc_gr002935

Removal:

- 10.7.1 Stop the machine and allow it to cool.
- 10.7.2 Remove the carburetor. See section *Removing Carburetor*.
- 10.7.3 Remove the muffler guard **(a)** (if equipped) and the muffler **(b)**.
- 10.7.4 Disconnect the connector **(c)** from the stop switch.
- 10.7.5 Remove the three socket head cap screws **(d)** that hold the engine to the crankcase.
- 10.7.6 Tilt the engine down and away to remove it from the crankcase.

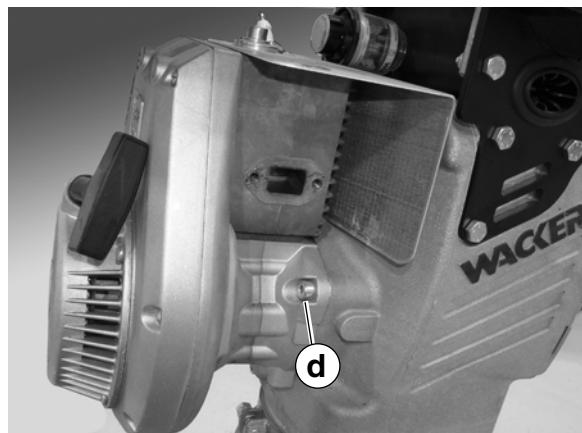
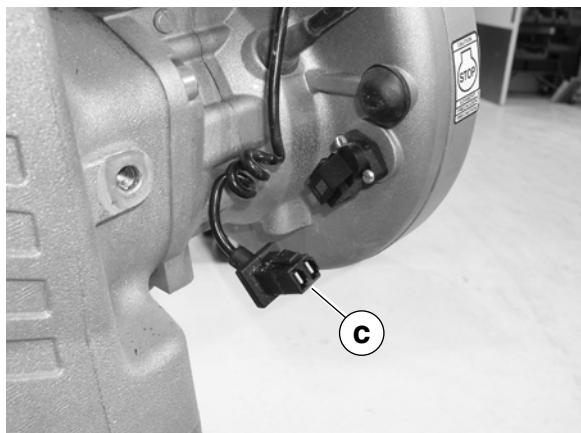
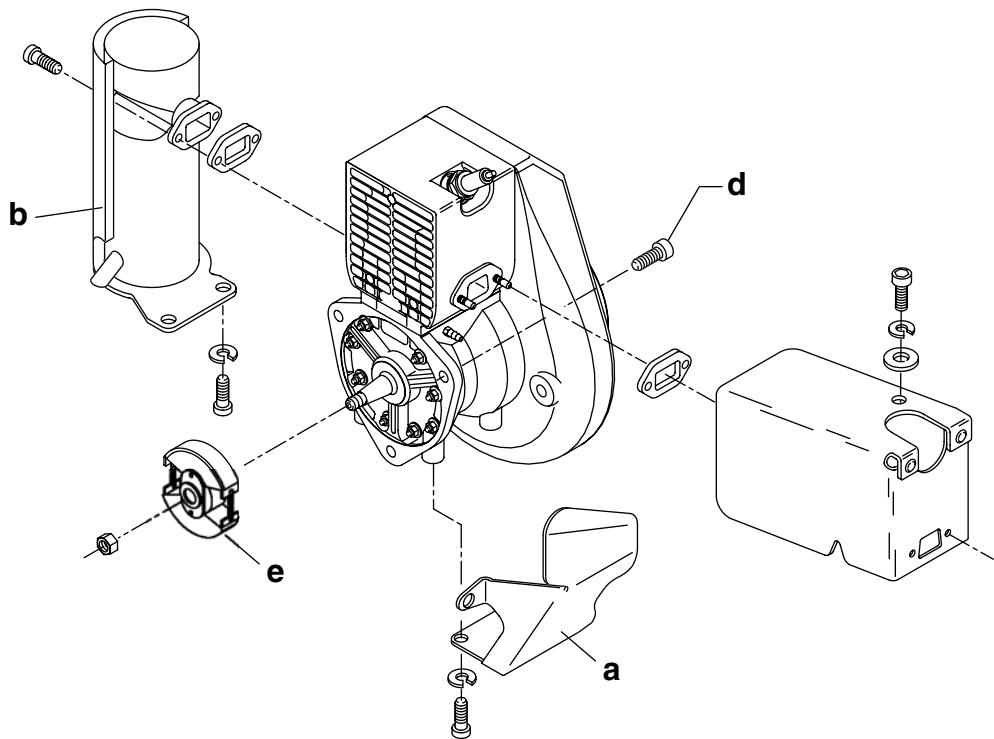
NOTICE: The rammer tips easily when the engine is removed.



DO NOT run the engine while it is off the machine unless the clutch **(e)** has been removed. Running the engine with the clutch attached to the crankshaft will cause the clutch shoes to separate and fly off.

Installation:

- 10.7.7 Position the engine onto the machine. Using Loctite 234 or equivalent on the three screws **(d)**, secure the engine to the machine. Torque the screws to 27 Nm (20 ft.lbs.).
- 10.7.8 Reconnect the stop switch.
- 10.7.9 Install the muffler **(b)** and muffler guard **(a)**.
- 10.7.10 Install the carburetor. See section *Removing Carburetor*.



wc_gr002935

10.8 Removing Engine From BH 23 Breakers

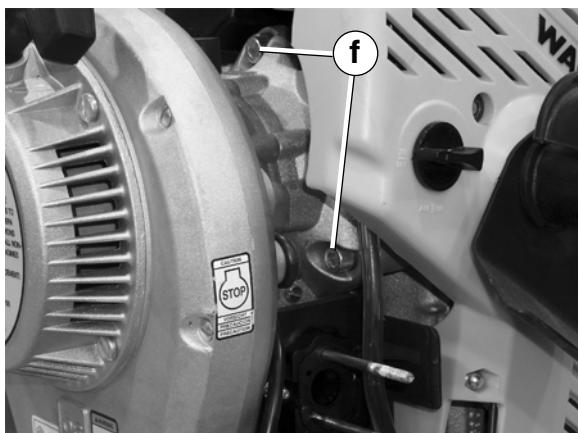
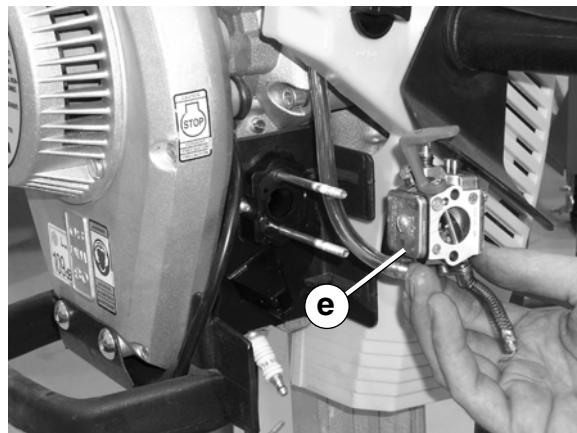
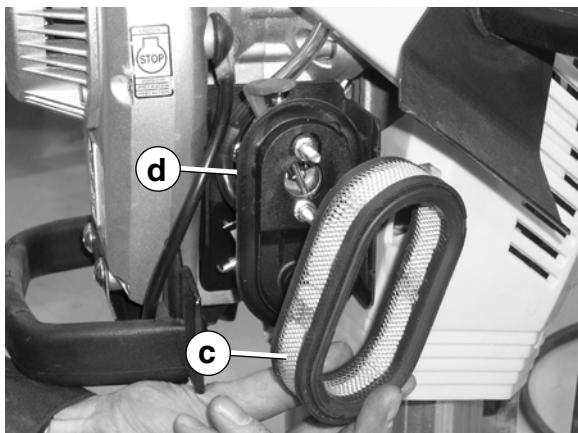
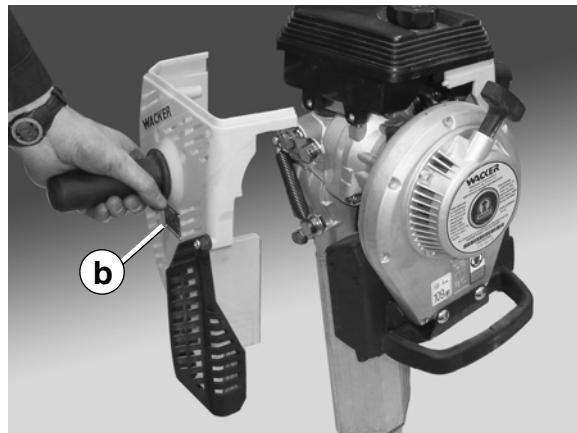
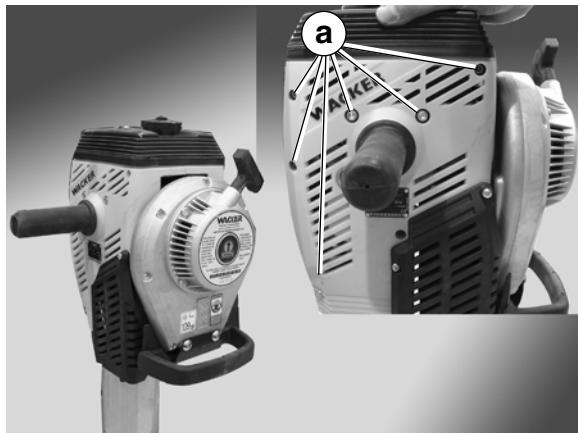
See Graphic: *wc_gr002937*

Removal:

- 10.8.1 Stop the machine and allow it to cool.
- 10.8.2 Remove the screws **(a)** and lock washers which secure the two shells together.
- 10.8.3 Remove the shell **(b)** opposite the throttle.
- 10.8.4 Remove the cover of the air cleaner, the air filter **(c)**, and the base of the air cleaner **(d)**.
- 10.8.5 Remove the carburetor **(e)**.
- 10.8.6 Remove the three socket head cap screws **(f)** that hold the engine to the crankcase and remove the engine.

Installation:

- 10.8.7 Position the engine onto the machine and secure it with three socket head cap screws **(f)**.
- 10.8.8 Install the carburetor **(e)**.
- 10.8.9 Install the base of the air cleaner **(d)**, the air filter **(c)**, and the cover of the air cleaner.
- 10.8.10 Secure the two shells to the machine with screws **(a)** and lock washers.



wc_gr002937

10.9 Removing Clutch

See Graphic: *wc_gr002941*

This procedure requires special tool P/N 0117972, puller.



DO NOT run the engine while it is off the machine unless the clutch has been removed. Running the engine with the clutch attached to the crankshaft will cause the clutch shoes to separate and fly off.

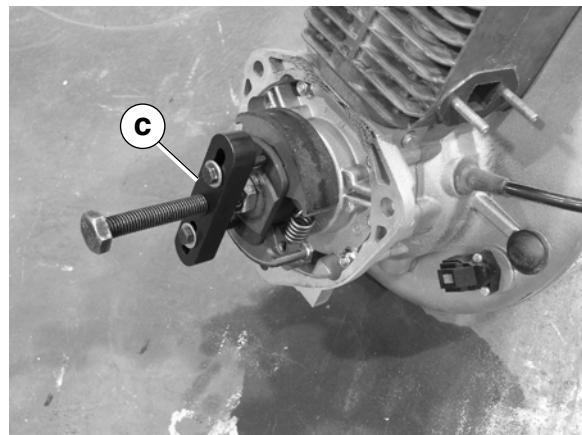
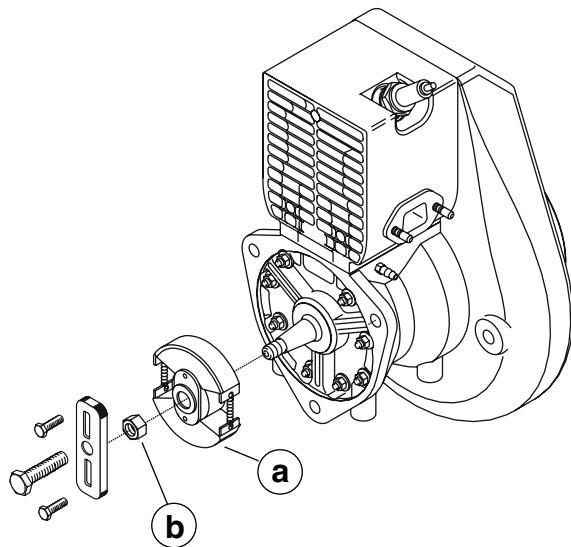
Removal:

- 10.9.1 Stop the machine and allow it to cool.
- 10.9.2 Remove the engine from the machine. See section *Removing Engine*.
- 10.9.3 Check the condition of the clutch shoes **(a)** and replace them if necessary. The clutch shoes should be absolutely dry. If oil is present, inspect the engine shaft seal.
- 10.9.4 Prevent the clutch from turning and use an air impact wrench and 17 mm socket to loosen the clutch nut **(b)**. If an impact wrench is not available, rap the wrench handle sharply to help break the nut loose.
Note: *Loosen the nut but do not completely remove it from the engine crankshaft. This will protect the crankshaft threads from the clutch puller screw.*
- 10.9.5 Screw the clutch puller (P/N 0117972) **(c)** (or other suitable puller) into the small holes in the clutch and turn the center screw against the end of the crankshaft until the clutch hub breaks free of the taper.

Note: *When reinstalling the clutch, make sure the taper in the clutch hub and on the engine crankshaft is absolutely free of any oil or grease.*

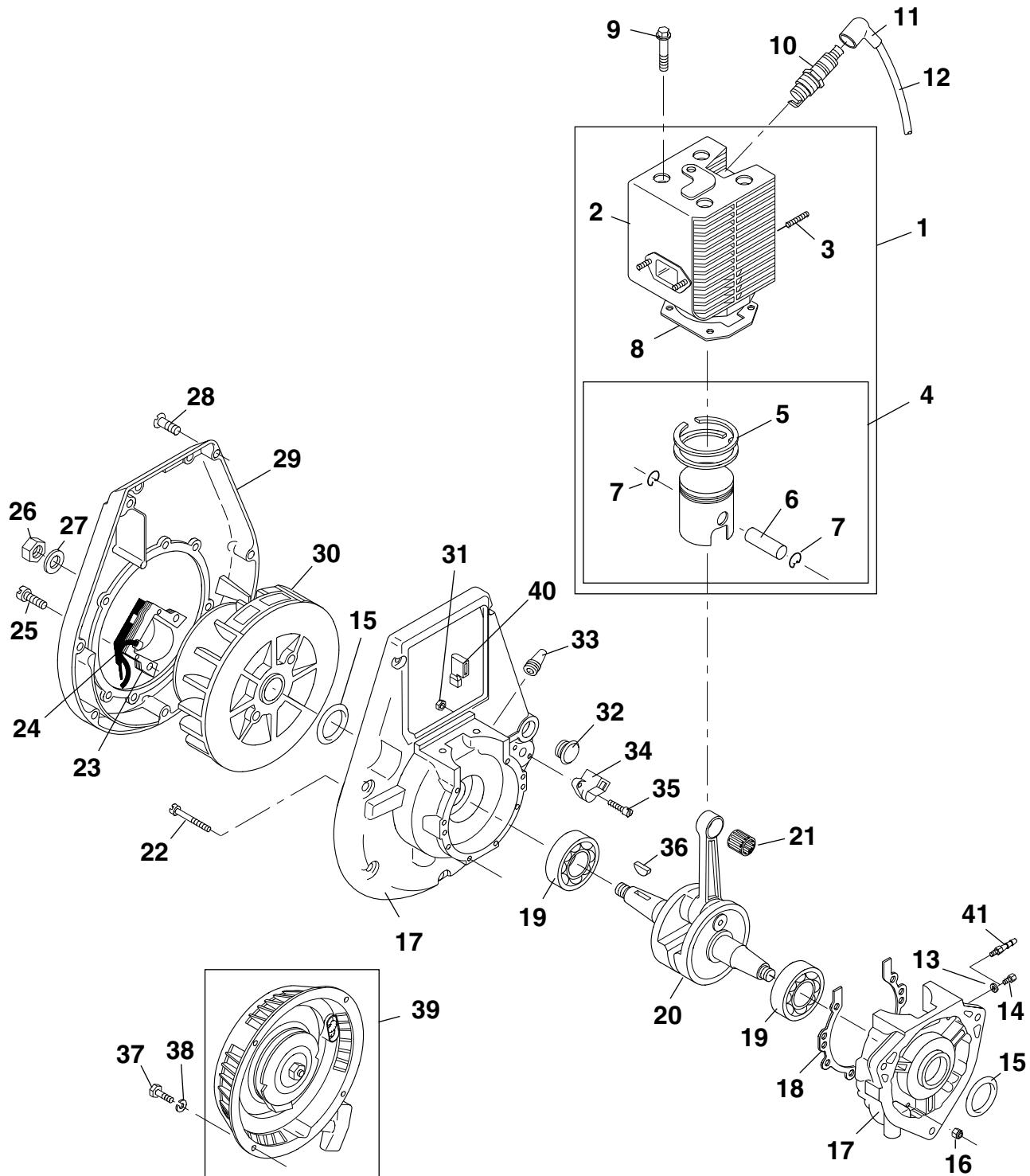
Installation:

- 10.9.6 Place the clutch on the engine crankshaft.
- 10.9.7 Reinstall the clutch nut and torque to 35 Nm (25 ft.lbs.).
- 10.9.8 Reinstall the engine on the crankcase. Torque the screws to 27 Nm (20 ft.lbs.).
- 10.9.9 Perform an operation check. Clutch should be disengaged with the throttle at the idle position.
Engine Speed (idle) (rpm): 1500 ± 200
Clutch Engagement (rpm): 2800 ± 200



wc_gr002941

10.10 WM 80 Exploded View



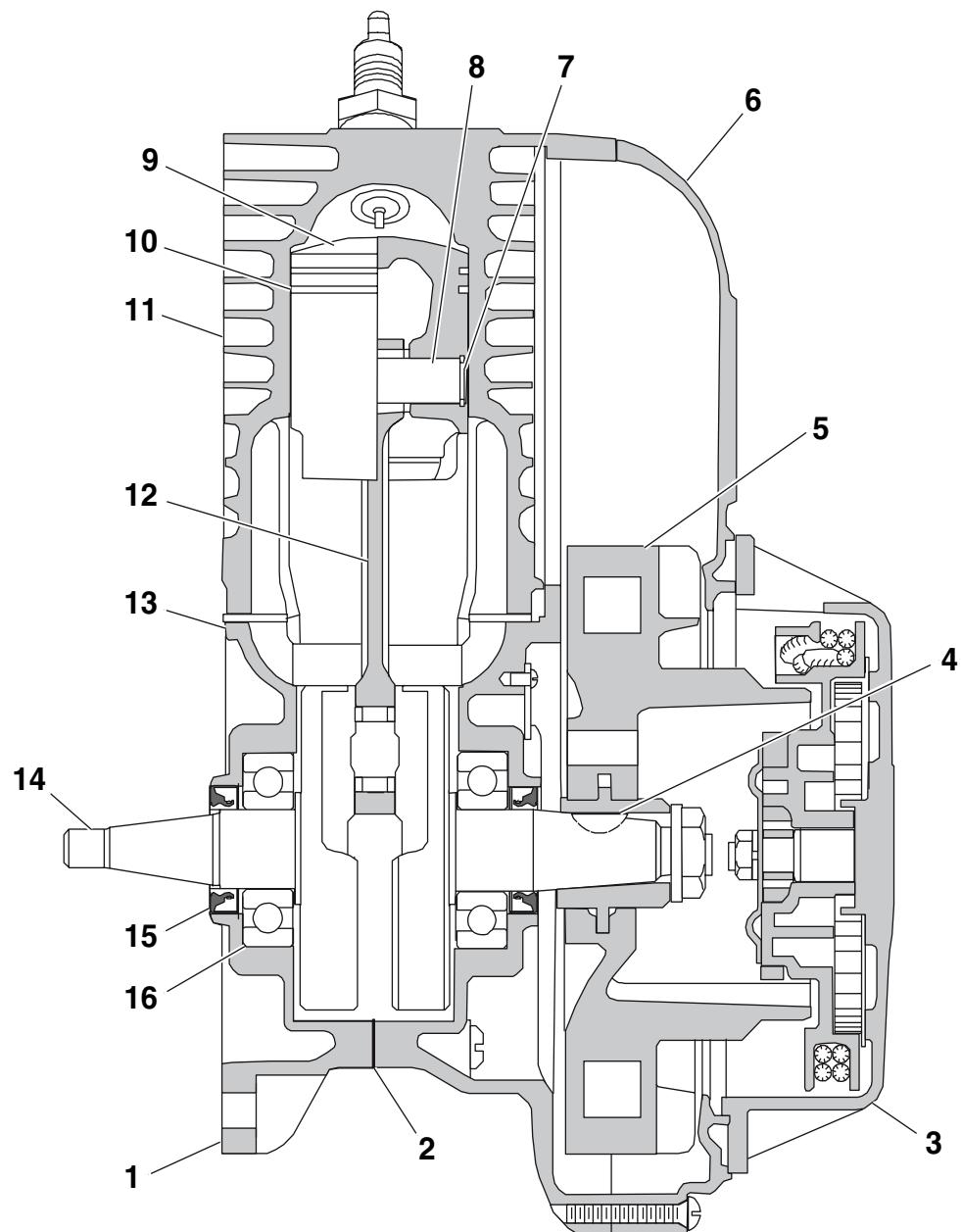
wc_gr002906

10.11 WM 80 Components

See Graphic: wc_gr002906

Ref	Description	Ref	Description
1	Set-cylinder	21	Needle bearing
2	Stud M6x18	22	Screw M5x55
3	Stud M5x20	23	Ignition module
4	Piston	24	Sleeve
5	Piston ring	25	Screw M5x20
6	Wrist pin	26	Nut M12x1.5
7	Retaining ring	27	Washer
8	Gasket	28	Screw M5x20
9	Screw M6x60	29	Flywheel housing
10	Spark plug	30	Flywheel
11	Spark plug cap	31	Locknut M3
12	Ignition cable	32	Cap
13	Sealing ring	33	Cable guide
14	Screw M5x8	34	Terminal post
15	Shaft seal	35	Screw M3x20
16	Nut M5	36	Woodruff key
17	Crankcase	37	Screw M6x12
18	Gasket	38	Lock washer
19	Ball bearing	39	Starter complete
20	Crankshaft	40	Terminal flag

10.12 WM 80 Cross Section



wc_gr002920

10.13 WM 80 Cross Section Components

See Graphic: wc_gr002920

Ref	Description	Ref	Description
1	Crankcase	9	Piston
2	Crankcase gasket	10	Piston rings
3	Recoil starter	11	Cylinder
4	Flywheel key	12	Connecting rod
5	Flywheel fan	13	Cylinder gasket
6	Fan hood	14	Crankshaft
7	Retaining ring	15	Shaft seal
8	Piston wrist pin	16	Crankshaft bearing

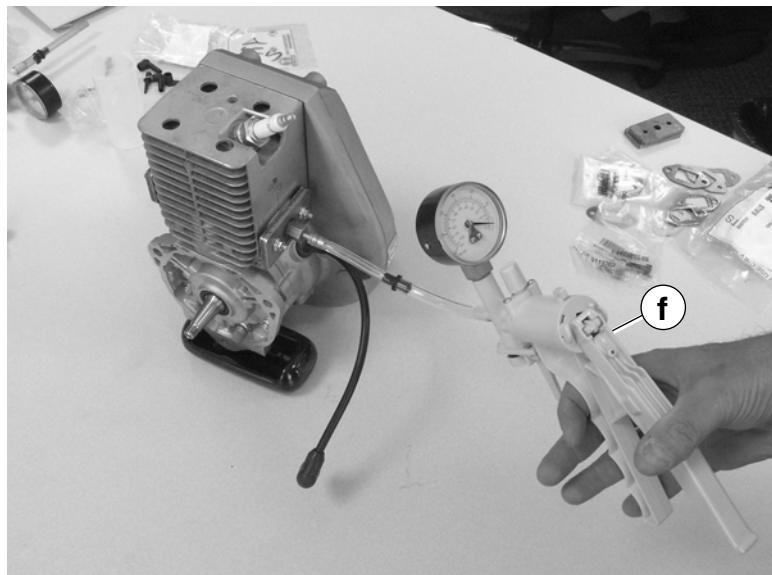
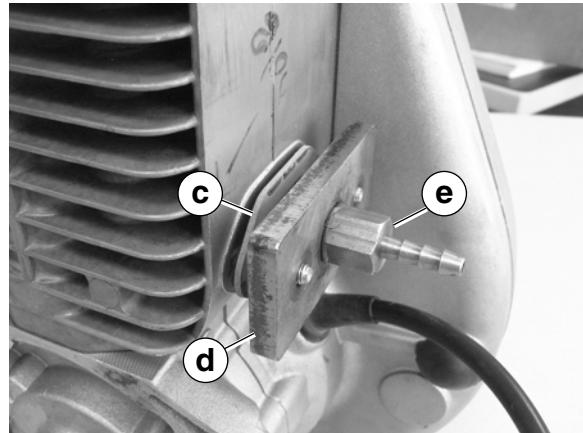
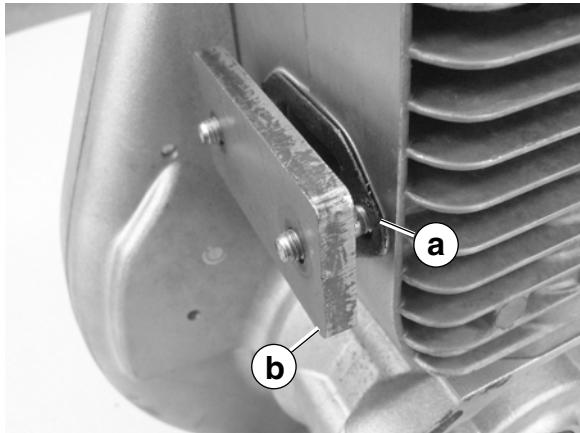
10.14 Vacuum Testing Cylinder

See Graphic: *wc_gr002940*

This procedure requires the use of test kit P/N 0155268, an 1/8 NPT hose barb, new gaskets, and a vacuum pump.

Note: For clarity, the engine is shown removed from the machine.

- 10.14.1 Remove the air cleaner or air cleaner duct.
- 10.14.2 Remove the carburetor. See section *Removing Carburetor*.
- 10.14.3 Remove the muffler.
- 10.14.4 Using the existing nuts, attach a new exhaust gasket **(a)** and the exhaust cover **(b)** over the exhaust port.
- 10.14.5 Using the existing nuts, attach a new intake gasket **(c)** and the intake cover **(d)** over the intake port. Attach an 1/8-inch NPT hose barb **(e)** to the intake cover.
- 10.14.6 Be sure that the spark plug and all the hardware securing the cylinder to the crank case is tight.
- 10.14.7 Attach the vacuum pump **(f)** to the hose barb. Operate the pump until 1.2–1.7 kPa (5–7 inches) of vacuum is reached. Observe the gauge for any drop in pressure. A drop of more than 0.25 kPa (1 in.) of vacuum per minute is considered unacceptable. All leaks should be located and rectified.
- 10.14.8 To locate a leak, squirt small amounts of oil around all possible leak areas. Reapply the vacuum and watch the gauge for a decrease in the leak rate. Replace the cylinder, hardware, or gaskets as needed.



wc_gr002940

10.15 Cylinder and Piston Removal

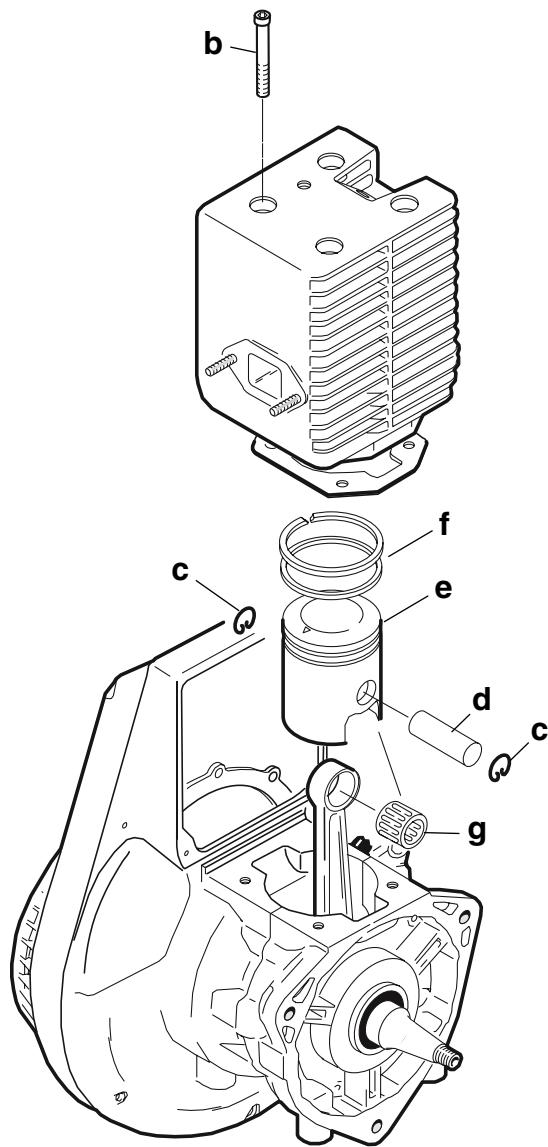
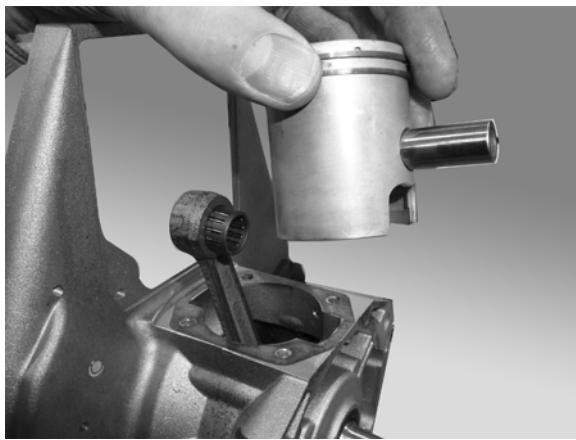
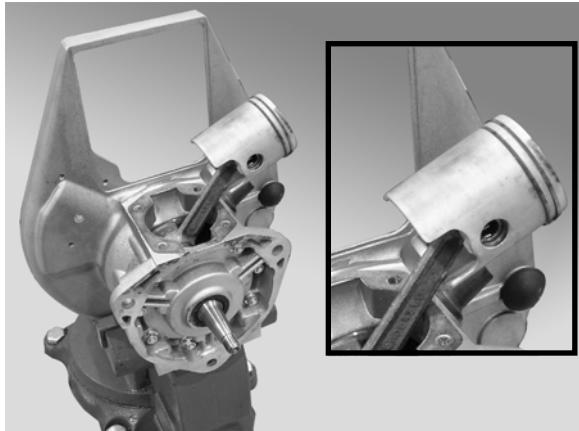
See Graphic: *wc_gr002907*

The cylinder and cylinder head is of a one-piece design providing easy access to the cylinder and piston and eliminating the need for a head gasket.

The cylinder bore is coated with a wear-resistant metal alloy. This allows heat to dissipate faster than using a cast iron cylinder sleeve. The lower operating temperature prevents the oil in the fuel/oil mixture from dissipating as readily, thus improving engine lubrication.

To remove the cylinder and piston, carry out the following procedure:

- 10.15.1 Disconnect and remove the spark plug from the engine.
- 10.15.2 Disconnect the fuel line and the throttle cable from the engine.
- 10.15.3 Remove the muffler, air filter, and carburetor from the engine. Remove the engine from the machine.
- 10.15.4 Remove the four M6 screws (**b**) holding the cylinder to the crankcase and remove the cylinder.
- 10.15.5 Remove the retaining rings (**c**) securing the piston pin (**d**) to the piston (**e**). Push the pin from the piston and remove the piston from the connecting rod.
- 10.15.6 Remove the piston rings (**f**) from the piston. Be careful not to break the rings or damage the ring's grooves when removing the rings.
- 10.15.7 Remove the needle bearing (**g**) from the connecting rod.



wc_gr002907

10.16 Cylinder and Piston Inspection

See Graphic: *wc_gr002908*

Ring Gap:

Remove the cylinder from the crankcase. Check the ring gap at the lower part of the cylinder by placing the ring (**h**) in the cylinder and measuring the gap between the ends of the ring. If the ring gap is greater than 1.2 mm (0.047 in.) the rings need to be replaced. Ring gaps should measure as follows:

New: 0.2 – 0.4 mm (0.008 – 0.016 in.)

Maximum: 1.0 – 1.2 mm (0.040 – 0.047 in.)

Piston Wear:

Piston wear is checked with a visual inspection. If the piston is noticeably worn or scored, it should be replaced. Typically, a piston will last through two sets of rings before requiring replacement.

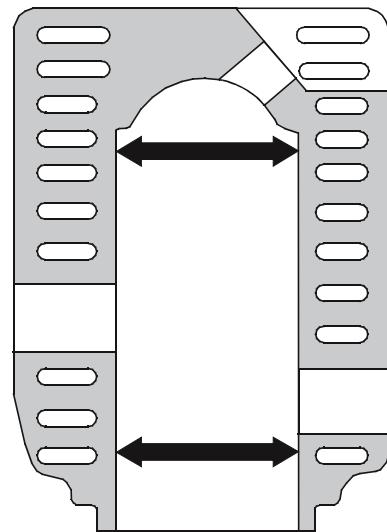
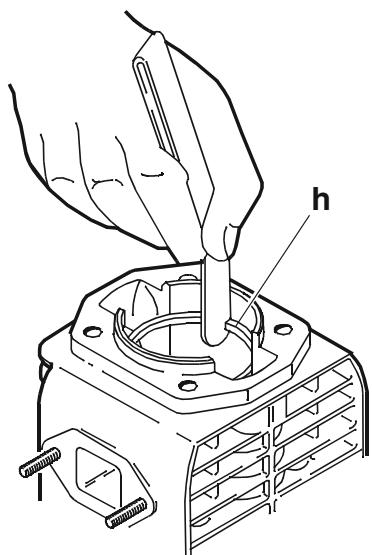
Cylinder Wear:

Remove the cylinder from the crankcase. Carefully remove any carbon deposits from the cylinder head, exhaust port, and piston head. Inspect the piston and cylinder visually for scoring. Check the cylinder coating for wear. If it has worn through, replace the cylinder.

NOTICE: Do not use a glaze breaker or hone on the cylinder. The metal alloy coating of the cylinder will be destroyed and render the cylinder useless.

Measure the cylinder wear by measuring the ring gap at the top of the cylinder and again at the bottom. Use a new ring if possible and the same ring for both measurements. If the difference in the two measurements is greater than 0.2 mm (0.008 in.), the cylinder is worn beyond its limits. Replace the cylinder, piston, and rings.

Typically, a cylinder will last through two pistons before requiring replacement.



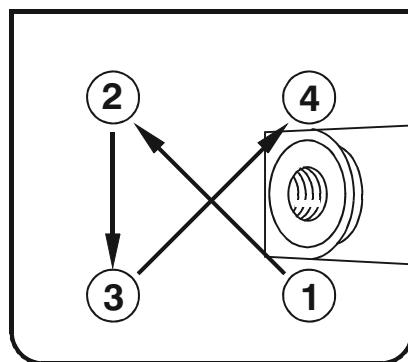
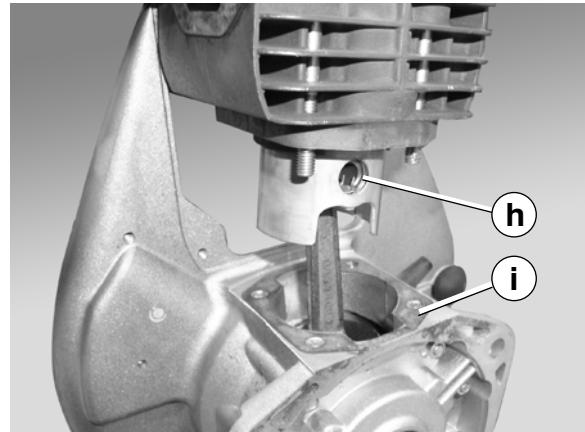
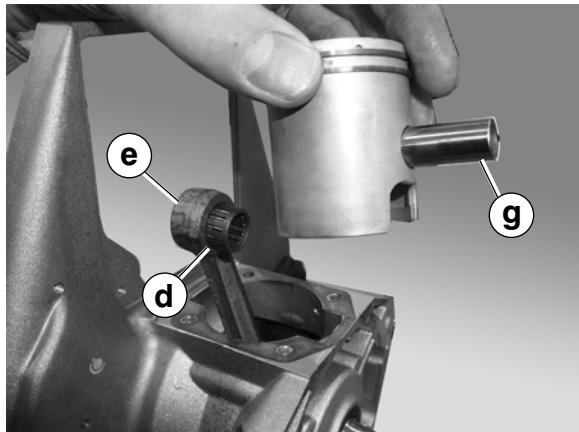
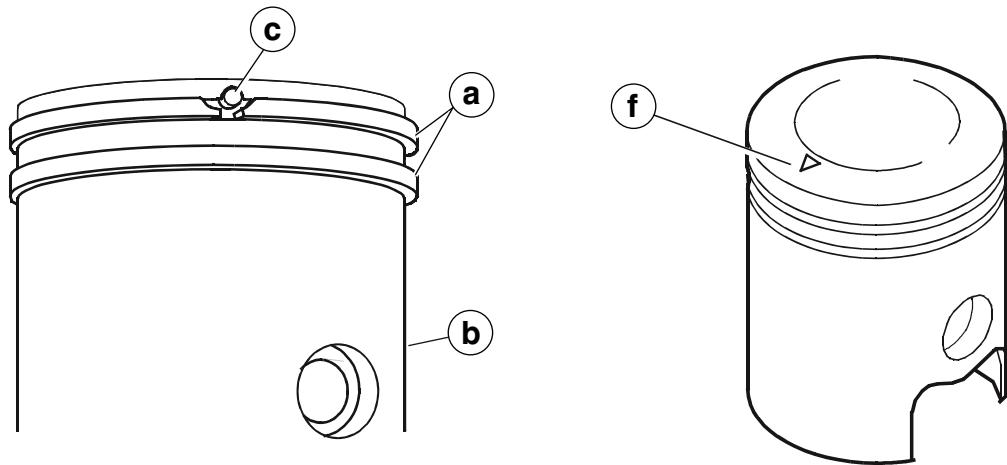
wc_gr002908

10.17 Cylinder and Piston Installation

See Graphic: *wc_gr002909*

This procedure requires the use of special tool P/N 0031986, ring compressor. It also requires the use of new retaining rings, P/N 0012257.

- 10.17.1 Remove all old gasket material from the cylinder and crankcase. Inspect the mating surfaces of the cylinder and crankcase for any deep scratches or defects which could prevent a good seal. The cylinder and crankcase must form an airtight seal for the engine to perform properly.
- 10.17.2 Install the rings **(a)** on the piston **(b)** with the notch in rings facing up, and around the pins **(c)** that are located in each groove of the piston.
- 10.17.3 Install the needle bearing **(d)** in the connecting rod **(e)**. Position the piston over the connecting rod with the arrow **(f)** stamped on the top of the piston pointing toward the exhaust side of the engine. Slide the wrist pin **(g)** in place. Secure the wrist pin with two new retaining rings **(h)**. Do not re-use old retaining rings.
- 10.17.4 Position the cylinder gasket **(i)** on the crankcase and lubricate the piston rings and cylinder bore with 2-cycle engine oil.
- 10.17.5 Using ring compressor P/N 0031986 to hold the rings in place, carefully slide the cylinder over the piston.
- 10.17.6 Secure the cylinder to the crankcase using M6 screws. Tighten the screws in the sequence shown and torque to 10 Nm (7 ft.lbs.).



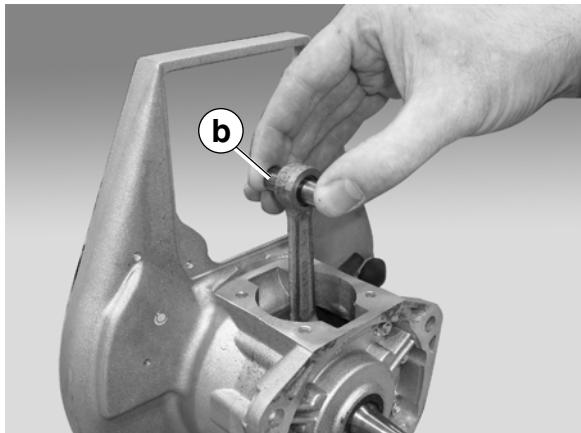
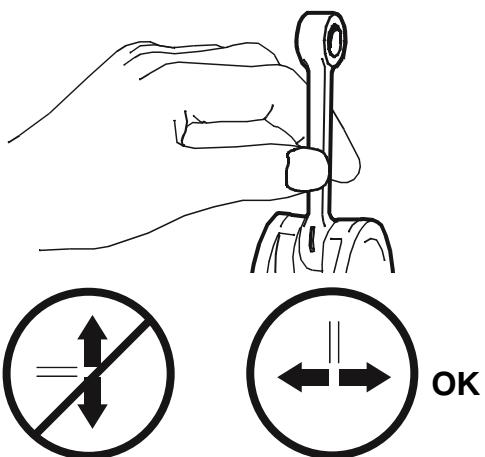
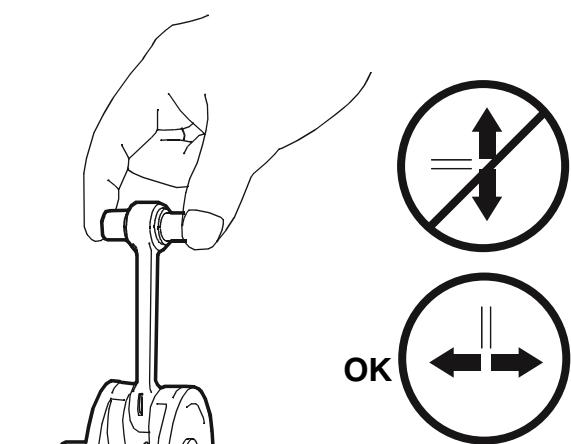
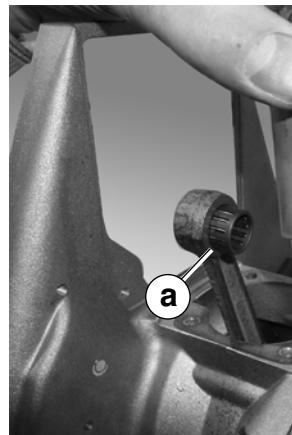
wc_gr002909

10.18 Inspecting Connecting Rod and Crankshaft

See Graphic: *wc_gr002910*

- 10.18.1 With the cylinder removed, check the needle bearing **(a)** for damage or wear. Replace it if necessary.
- 10.18.2 Insert the wrist pin into the needle bearing and check for excessive play. Replay the needle bearing and/or the wrist pin if necessary.
- 10.18.3 Check the connecting rod **(b)** for any vertical play—there should be none. Side play is allowable. If any vertical play is present, the complete crankshaft assembly must be replaced.
- 10.18.4 Turn the crankshaft by hand and check that the shaft bearings rotate freely. Replace worn or damaged bearings.
- 10.18.5 If a piston ring is broken, inspect the crankcase and bearings to be sure that no ring pieces have become lodged inside the engine. Flush the crankcase using an oil-rich fuel mixture.

Note: *When replacing the crankshaft, the crankshaft bearings and the needle bearing for the piston wrist pin must also be replaced.*



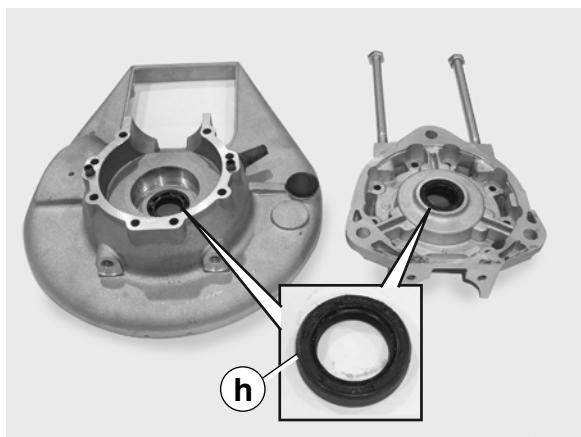
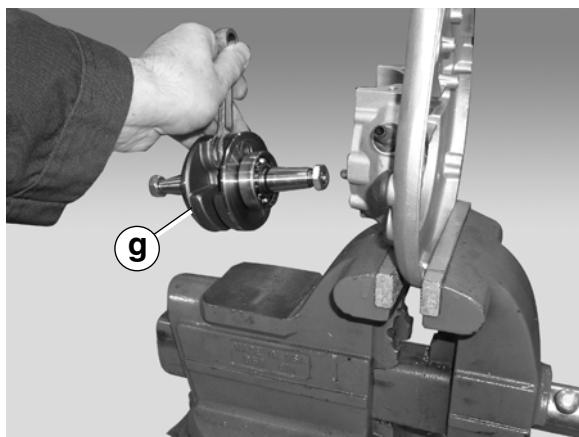
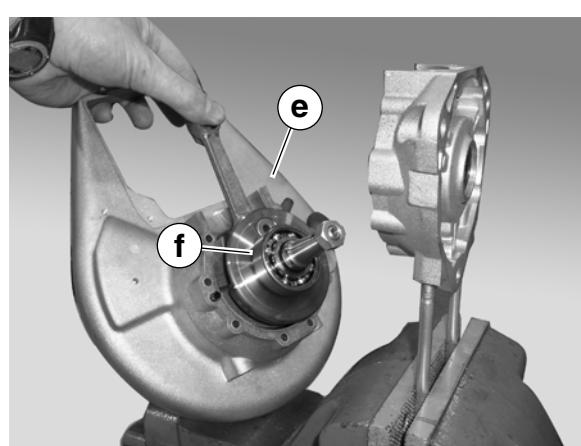
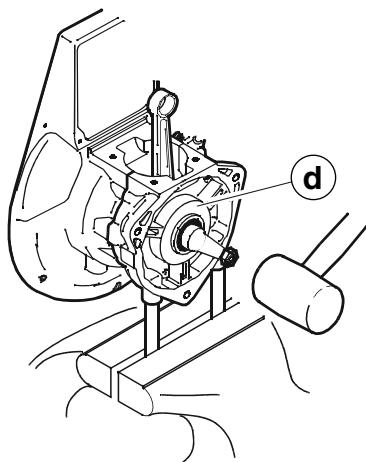
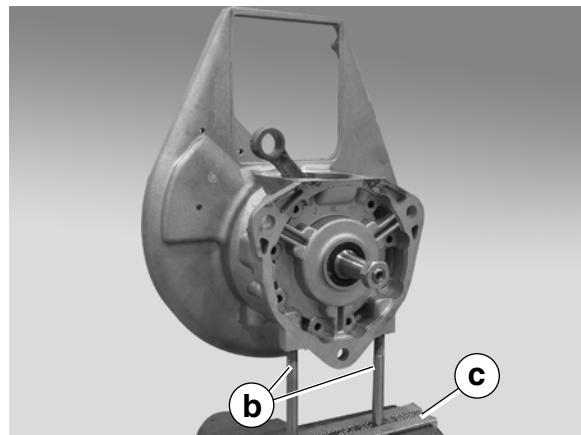
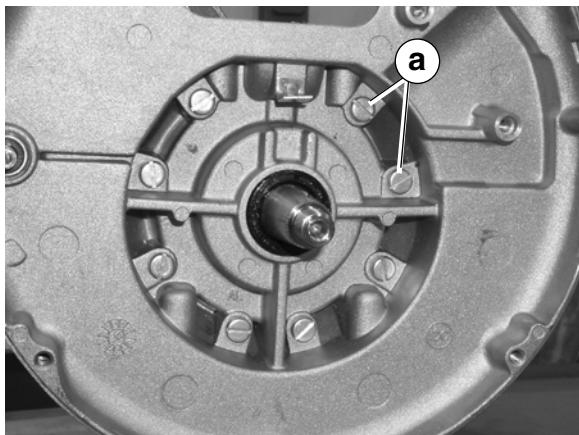
wc_gr002910

10.19 Disassembling Crankcase

See Graphic: *wc_gr002911*

- 10.19.1 Remove the clutch, starter, flywheel, cylinder, and piston. Place the nut back on the shaft to protect shaft threads.
- 10.19.2 Remove eight M5 screws **(a)** which secure the crankcase halves together.
- 10.19.3 Secure the crankcase in vice or equivalent.

Note: *It is suggested that M8 cap screws **(b)** be screwed into clutch end of crankcase. Then secure crankcase in vise **(c)** using the capscrews.*
- 10.19.4 Heat the area **(d)** of the crankcase around the bearing using a propane torch.
- 10.19.5 While the crankcase is hot, tap firmly on the end of the crankshaft with a plastic mallet to remove the crankcase from the shaft. Support the crankcase shell/crankshaft **(e)** as it slides from the other half of the crankcase shell. The bearing **(f)** will remain intact on the shaft.
- 10.19.6 Support the other half of the crankcase shell/crankshaft. Heat the area of the crankcase around the bearing using a propane torch.
- 10.19.7 While the crankcase is hot, tap firmly on the end of the crankshaft with a plastic mallet to remove the crankshaft **(g)** from the crankcase shell.
- 10.19.8 Once the crankcase shell halves have cooled, remove the crankshaft seals **(h)** from each shell.



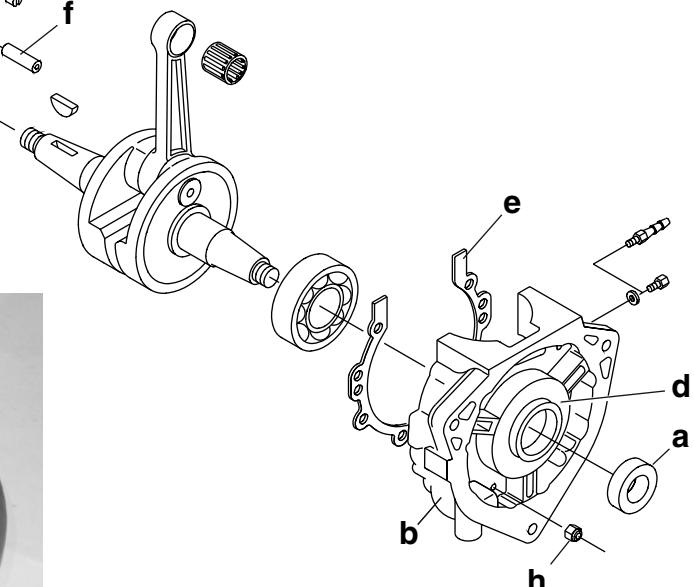
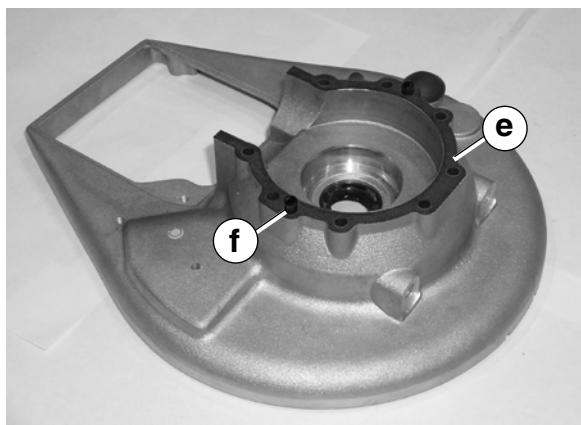
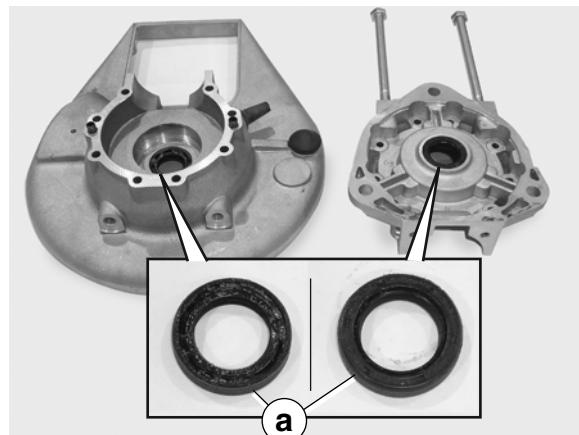
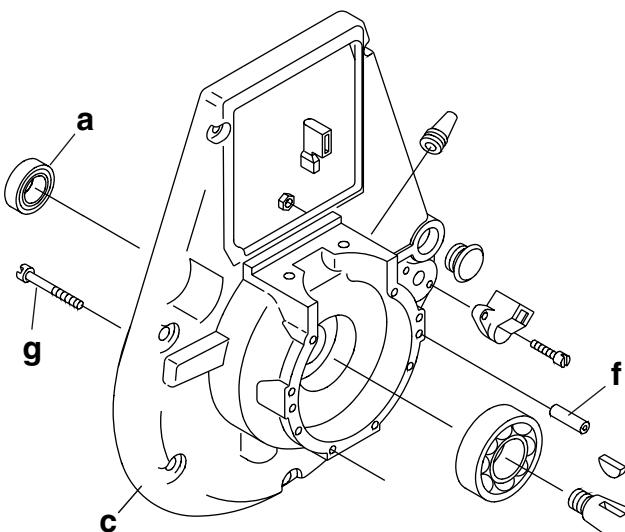
wc_gr002911

10.20 Assembling Crankcase

See Graphic: *wc_gr002912*

This procedure requires a propane torch or equivalent heat source.

- 10.20.1 Lubricate the shaft seals **(a)** using 2-cycle engine oil. Position one of the seals over the bore in the crankcase shell **(b)** with the open side of the seal facing in. Make sure the seal is laying straight and press it into the bore, from the outer side, using pusher P/N 0048585. Press until the outer edge of the seal is flush with the outer edge of the crankcase shell. In the same manner, press the other shaft seal into the other crankcase shell **(c)**.
- 10.20.2 Lubricate both crankshaft bearings with 2-cycle engine oil.
- 10.20.3 Heat the area **(d)** of the crankcase shell **(b)** using a propane torch. Heat the area to approximately 70°– 80°C (150°–175°F). Be careful not to damage the seal when heating. Install the crankshaft into the warm crankcase shell.
- Note:** *The crankshaft should slide easily into the crankcase shell if heated sufficiently.*
- 10.20.4 Lightly oil gasket **(e)** with 2-cycle engine oil. Position the gasket over the roll pins **(f)** in crankcase shell **(c)**.
- 10.20.5 Heat crankcase shell **(c)** using a propane torch (In the same manner as crankcase shell **(b)** in step 3.) Heat the area to approximately 70°– 80°C (150°–175°F). Be careful not to damage the seal when heating. Install the crankshaft into the warm crankcase shell and push the crankcase shells together until they are tight.
- 10.20.6 Allow the preassembled crankcase to cool. When cool, secure it together with M5 screws **(g)** and nuts **(h)**. Tighten the screws in steps and torque to 6.5 Nm (5 ft.lbs.).
- 10.20.7 After the crankcase is assembled, tap it lightly on the end to release any bearing tension. Check the assembly by turning the crankshaft by hand. The crankshaft should turn easily.
- 10.20.8 Trim off any excess gasket material from the outside of the engine and at the top of the cylinder mounting surface.



wc_gr002912

10.21 Crankshaft Bearings

See Graphic: *wc_gr002913*

Press Method Removal:

This procedure requires special tools P/N 0023338, split ring puller (**a**); and P/N 0023339, crank support tube (**b**). It also requires the use of an Arbor press or equivalent.

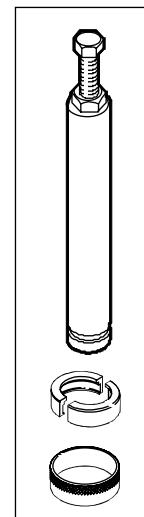
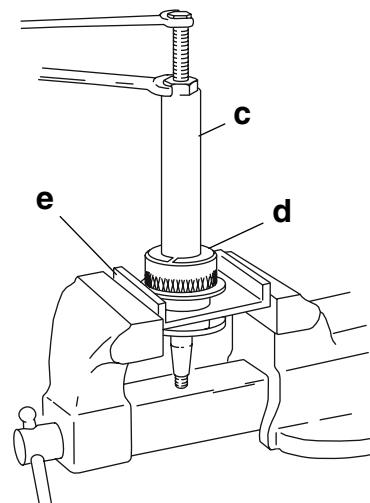
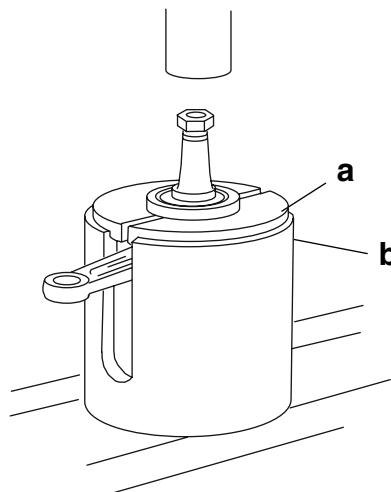
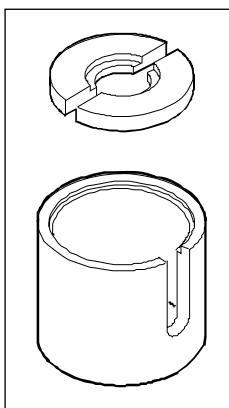
- 10.21.1 Place the two halves of the split ring puller around the bearing on the crankshaft. If necessary, tap gently on the ring halves to seat them under the bearing.
- 10.21.2 Secure the complete assembly in the crank support tube.
- 10.21.3 Using an Arbor press, press on the end of the crankshaft until the bearing breaks free.

Note: *Support the crankshaft as it slides from the bearing.*

Extractor Method Removal:

If a press is not available, the bearings can be pulled from the shaft using the following special tools: P/N 0013288, extractor (**c**); P/N 0017328, half shell (**d**); and P/N 0013290, holding ring (**e**).

- 10.21.4 Assemble the tools to the bearing as shown.
- 10.21.5 Turn the center bolt of the extractor until the bearing breaks free of the shaft.



wc_gr002913

10.22 Bearing Installation

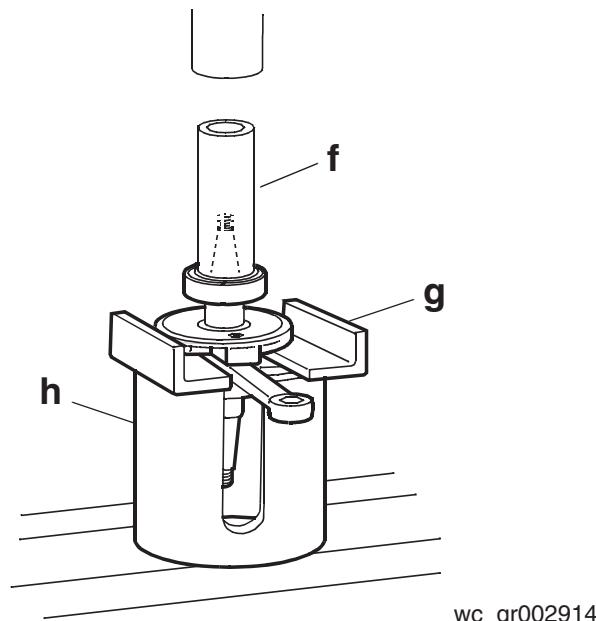
See Graphic: *wc_gr002914*

This procedure requires special tools P/N 0048585, pusher tube (**f**); P/N 0032028, crank support plate (**g**); and P/N 0023339 crank support tube (**h**).

- 10.22.1 Slide the support plate between the counterweights at the center of the crankshaft as far as possible, then place it on the support tube so that the counterweight on the crankshaft is fully supported.
- 10.22.2 Lubricate the inner bearing race and the crankshaft using 2-cycle engine oil.
- 10.22.3 Using the pusher tube, press the bearing onto the crankshaft until the bearing rests against the shoulder of the crankshaft.

NOTICE: When pressing, press only on the inner bearing race. Pressing on any other surface of the bearing may damage the bearing.

NOTICE: Failure to support the crankshaft properly while installing the bearings may cause the shaft to break.



wc_gr002914

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